

2015-2016 LONG SIGNATURE SHEET



Proposal Number: CCI 04-12-2015

Proposal Title: Updates to the B.A. and B.S. in Computer Science

Originating Department: College of Computing and Informatics

TYPE OF PROPOSAL: UNDERGRADUATE XX GRADUATE _____ UNDERGRADUATE & GRADUATE _____
(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
			Approved	DEPARTMENT CHAIR Mary Lou Maher, Larry Mays, Bojan Cukic 12/7/15
			Approved	COLLEGE CURRICULUM COMMITTEE CHAIR Jun-tao Guo 12/7/15
			Approved	COLLEGE FACULTY CHAIR (if applicable) Yu Wang 11/8/15
			Approved	COLLEGE DEAN Yi Deng
			Approved	GENERAL EDUCATION (if applicable; for General Education courses) [print name here:]
			Approved	HONORS COLLEGE (if applicable; for Honors courses & programs) [print name here:]
			Approved	UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR (for undergraduate content)
			Approved	GRADUATE COUNCIL CHAIR (for graduate content)
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

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UNC CHARLOTTE

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*Proposals for undergraduate courses and programs should be sent to the Undergraduate Course and Curriculum Committee Chair. Proposals related to both undergraduate and graduate courses, (e.g., courses co-listed at both levels) must be sent to both the Undergraduate Course and Curriculum Committee and the Graduate Council.

I. HEADING AND PROPOSAL NUMBER

- A. **HEADING.** Place a three line double-spaced heading containing the following information at the top of the first page of the proposal and beginning at the left margin:

University of North Carolina at Charlotte

Revised; Undergraduate

Course and Curriculum Proposal from: College of Computing and Informatics

- B. **PROPOSAL NUMBER.** Place the proposal number in the upper right corner of page one of the proposal. The proposal number will consist of the abbreviation of the originating unit and the date the proposal was approved by the unit, e.g., BIO 7-24-02. If more than one proposal is passed on a specific date, assign alpha suffixes to distinguish them (e.g., BIO 7-24-02a and BIO 7-24-02b). Submit multiple courses as a single proposal when possible.

- C. **TITLE.** Updates to the B.A. and B.S. in Computer Science

II. CONTENT OF PROPOSALS

A. PROPOSAL SUMMARY.

1. **SUMMARY.** State clearly and concisely the actions proposed (e.g., “the Biology Department proposes to add four new elective courses to the undergraduate curriculum: BIO 2222, BIO 3456, BIO 2345, and BIO 3210).

We propose changes to the Computer Science degrees (B.A. and B.S.) to support a common core across each of the degrees. The updated degrees provide a consistent structure for ten concentrations. These concentrations enable us to:

- provide more academic opportunities to students,
- support more options in the ever growing field of computing,

The core for the B.S. degree consists of eight courses and supports seven concentrations. The B.A. degree has five core courses supporting three concentrations.

The B.S. concentrations are (department in parenthesis):

- Bioinformatics (Bioinformatics and Genomics)
- AI, Robotics & Gaming (Computer Science)
- Data Science (Computer Science)
- Software, Systems & Networking (Computer Science)
- Cyber Security (Software & Information Systems)
- Software Engineering (Software & Information Systems)
- Web & Mobile Applications (Software & Information Systems)

The B.A. concentrations are (department in parenthesis):

- Financial Services Informatics (Computer Science)
- Human-Computer Interaction (Software & Information Systems)
- Information Technology (Software & Information Systems)

B. JUSTIFICATION.

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

The field of Computer Science has undergone incredible growth in the last decade. Demand for degrees in the College of Computing and Informatics is at an all time high. The changes proposed provide more flexibility for the students, and enable us to streamline our course offerings to better handle increased student demand. The updated degrees provide a consistent structure for all concentrations.

2. Discuss prerequisites/corequisites for course(s) including class-standing, admission to the major, GPA, or other factors that would affect a student's ability to register.

We proposed minor changes to existing courses to change prerequisites and to accommodate the common core across the different concentrations.

- All *core* courses have been renamed from ITCS or ITIS to ITSC to reflect the fact that they are common to all three departments in the College of Computing and Informatics. Course numbers (e.g., 1212, 1213, etc.) remains the same, only the discipline code (ITSC) has changed.
- A few courses prerequisites have changed to allow more flexibility in the ordering of courses across the different concentrations.
- The course ITSC 1212 – Introduction to Computer Science I now has more coverage of object-oriented programming, a topic that was there in the ITIS version of the course.

- The course ITSC 1213 – Introduction to Computer Science II has reduced topics in OO (now in 1212), increased coverage on arrays and lists, and added coverage of basic data structures.
- The course ITSC 2175 - Logic and Algorithms added coverage on order of complexity and coverage of basic automata.
- The course ITSC 2214 - Data Structures and Algorithms has a reduction of coverage of basic data structures (now in 1213), reduced coverage of complexity (now in 2175), and added coverage of algorithm analysis (formerly in 2215).
- The course ITSC 3146 Introduction to Operating Systems and Networking has been updated to removed assembly programming and socket programming and added system administration topics.
- The course ITCS 3181+L Logic and Computer Systems has been renamed to ITSC 3181+L Introduction to Computer Architecture and the content has been restructured to match the new prerequisite sequence.
- The course ITCS 4120 Introduction to Computer Graphics is being renumbered to ITCS 3120 to reflect its position within the new curriculum.
- The course ITCS 3153 Intro to Artificial Intelligence has been revised to cover intro AI topics (70%) and serve as an introduction to sub-fields within the AI/Robotics & Gaming concentration (30%).
- The course number for ITCS 3145 Parallel Computing has been changed from the current ITCS 4145 to 3145.
- The course ITCS 4124 3D Graphics Foundations for Games, Visualization and Augmented Reality has been renamed to ITCS 4124 Advanced 3D Computer Graphics

We have created new courses to help support some of the new concentrations. The new courses are:

- ITCS 3145 – Parallel and Distributed Computing
- ITCS 3190 – Cloud Computing for Data Analysis
- ITCS 4111/5111 – Introduction to Natural Language Processing
- ITCS 4150 – Mobile Robotics
- ITCS 4182 – Introduction to High-Performance Computing
- ITCS 4238 Intelligent and Interactive System Studio

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

All courses (new and updated) are consistent with the course numbering guidelines listed in the current undergraduate course

catalog. All new numbers were selected to ensure that pre-requisites have smaller numbers than the new course. Furthermore, advanced courses are numbered in the 4xxx so they can be cross-listed with 5xxx level courses and available for our graduate students.

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

The proposed changes improve our instruction in the following ways.

- Students can select from one of ten concentrations with a common core, allowing them to make the selection in their sophomore or junior year.
 - Core across three departments allows us to distribute the teaching load among a larger group of professors and instructors.
5. If course(s) has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.

N/A

- C. **IMPACT.** Changes to courses and curricula often have impacts both within the proposing department as well as campus-wide. What effect will this proposal have on existing courses and curricula, students, and other departments/units? Submit an Impact Statement that fully addresses how you have assessed potential impacts and what the impacts of this proposal might be. Consider the following:

1. What group(s) of students will be served by this proposal? (Undergraduate and/or graduate; majors and/or non-majors, others? Explain). Describe how you determine which students will be served.

This proposal serves all undergraduate students in the College of Computing and Informatics.

2. What effect will this proposal have on existing courses and curricula?
 - a. When and how often will added course(s) be taught?
 - b. How will the content and/or frequency of offering of other courses be affected?
 - c. What is the anticipated enrollment in course(s) added (for credit and auditors)?
 - d. How will enrollment in other courses be affected? How did you determine this?
 - e. Identify other areas of catalog copy that would be affected, including within other departments and colleges (e.g., curriculum

outlines, requirements for the degree, prerequisites, articulation agreements, etc.)

N/A

III. RESOURCES REQUIRED TO SUPPORT PROPOSAL.

When added resources are not required, indicate “none”. For items which require “none” explain how this determination was made.

- A. PERSONNEL.** Specify requirements for new faculty, part-time teaching, student assistants and/or increased load on present faculty. List by name qualified faculty members interested in teaching the course(s).

None

- B. PHYSICAL FACILITY.** Is adequate space available for this course?

None

- C. EQUIPMENT AND SUPPLIES:** Has funding been allocated for any special equipment or supplies needed?

No

- D. COMPUTER.** Specify any computer usage (beyond Moodle) required by students and/or faculty, and include an assessment of the adequacy of software/computing resources available for the course(s).

N/A

- E. AUDIO-VISUAL.** If there are requirements for audio-visual facilities beyond the standard classroom podiums, please list those here.

None

- F. OTHER RESOURCES.** Specify and estimate cost of other new/added resources required, e.g., travel, communication, printing and binding.

None

- G. SOURCE OF FUNDING.** Indicate source(s) of funding for new/additional resources required to support this proposal.

Not required

IV. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

- A. LIBRARY CONSULTATION.** Indicate written consultation with the Library Reference Staff at the departmental level to ensure that library holdings are adequate to support the proposal prior to its leaving the department. (Attach copy of [*Consultation on Library Holdings*](#)).

See attachment

- B. CONSULTATION WITH OTHER DEPARTMENTS OR UNITS.** List departments/units consulted in writing regarding all elements outlined in IIC: Impact Statement, including dates consulted. Summarize results of consultation and attach correspondence. Provide information on voting and dissenting opinions (if applicable).

N/A

- C. HONORS COUNCIL CONSULTATION.** In the case of Honors courses or Honors programs indicate written consultation with the Honors Council (if applicable).

N/A

V. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

- A. ORIGINATING UNIT.** Briefly summarize action on the proposal in the originating unit including information on voting and dissenting opinions.

Proposal was discussed in the CCI Undergraduate Education committee and approved on December 4, 2015.

- B. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)**

Review statement and check box once completed:

- The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a [credit hour](#).

- C. ATTACHMENTS.**

1. CONSULTATION: Attach relevant documentation of consultations with other units.
2. COURSE OUTLINE/SYLLABUS: For undergraduate courses attach course outline(s) including basic topics to be covered and suggested textbooks and reference materials with dates of publication. For Graduate Courses attach a course syllabus. Please see [Boiler Plate for Syllabi for New/Revised Graduate Courses](#).
3. PROPOSED CATALOG COPY: Copy should be provided for all courses in the proposal. Include current subject prefixes and

course numbers, full titles, credit hours, prerequisites and/or corequisites, concise descriptions, and an indication of when the courses are to be offered as to semesters and day/evening/weekend. Copy and paste the [current catalog copy](#) and use the Microsoft Word “track changes” feature (or use **red text with “~~strikethrough~~”** formatting for text to be deleted, and adding **blue text with “underline”** formatting for text to be added).

- a. For a new course or revisions to an existing course, check all the statements that apply:

- This course will be cross listed with another course.
 There are prerequisites for this course.
 There are corequisites for this course.
 This course is repeatable for credit.
 This course will increase/decrease the number of credits hours currently offered by its program.
 This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

For all items checked above, applicable statements and content must be reflected in the proposed catalog copy.

- b. If overall proposal is for a new degree program that requires approval from General Administration, please contact the facultygovernance@uncc.edu for consultation on catalog copy.

4. ACADEMIC PLAN OF STUDY (UNDERGRADUATE ONLY): Does the proposed change impact an [existing Academic Plan of Study](#)?

- Yes. If yes, please provide updated Academic Plan of Study in template format.
 No.

5. STUDENT LEARNING OUTCOMES (UNDERGRADUATE & GRADUATE): Does this course or curricular change require a change in Student Learning Outcomes (SLOs) or assessment for the degree program?

- Yes. If yes, please provide updated SLOs in template format.
 No.

6. TEXTBOOK COSTS: It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

- Yes. Briefly explain below.
 No. Briefly explain below.

Recommended texts are mentioned where appropriate and are commonly available in various formats, including printed, rental, and electronic.

IMPORTANT NOTE: A Microsoft Word version of the final course and curriculum proposal should be sent to facultygovernance@uncc.edu upon approval by the Undergraduate Course and Curriculum Committee and/or Graduate Council chair.



PROGRAM SUMMARY

- **Credit Hours:** 120 hours
- **Concentrations:** Financial Services Informatics, Human-Computer Interaction, Information Technology
- **Declaring the Major:** Minimum GPA of 2.5 required; no pre-requisite courses; change of major form accepted year-round; advising session required after declaration
- **Advising (For the Major):** Required on admission to the major and before each semester, assigned advisors available by appointment
- **Advising (For General Education):** Required on admission to the major and before each semester, assigned advisors available by appointment
- **Minimum Grades/GPA:** GPA of 2.0 in the major required for graduation
- **Teacher Licensure:** No
- **Evening Classes Available:** Some
- **Weekend Classes Available:** No
- **Other Information:** Freshman Learning Community, CCI Honors, Internships, Co-ops, Graduate Early Entry
- **Contact(s):** For Financial Services Informatics Concentration: James Frazier, Assistant Chair and Undergraduate Coordinator, Woodward Hall 410-B, 704-687- 8557, jfrazie2@uncc.edu; for Human-Computer Interaction or Information Technology Concentrations: Bruce Long, Assistant Chair and Director of Undergraduate Programs, 704-687-8441, nblong@uncc.edu, Woodward Hall 310-E.

PROGRAM REQUIREMENTS

The B.A. in Computer Science is a relatively structured degree with three (3) concentrations, Financial Services Informatics, Information Technology (IT) and Human-Computer Interaction (HCI). The B.A. includes a core of 5 courses that are generally prerequisites for upper level courses. Due to the large number of major requirements it is recommended that students declare the major in their freshman year and the concentration in their sophomore year to complete their degree on time. Two of the concentrations (IT and HCI) require 15 semester hours of related work in a discipline outside computer science, possibly forming a minor in that discipline area.

Areas	Credit Hours	Description
Pre-Major/Prerequisites		
Major	72-90	Computer Science Core 15 hours - ITSC 1212/L, 1213/L, 1600, 2175, 2214; Computer Science Concentration one of three concentration areas: Financial Services Informatics (51 hours), Human-Computer Interaction (24 hours), or Information Technology (27 hours); Major Electives 9 hours for HCI and 6 hours for IT - all at the 3000 level or above, and in the College of Computing and Informatics; Capstone 3 hours for HCI and IT, 6 hours Financial Services Informatics. Major requirements (all concentrations): Communication– ENGL 2116, ITCS 3688; Analytic - PHIL 1106, MATH 1120, STAT 1220, and STAT 2223.
General Education (not satisfied by other major requirements)	28-31	UWRT 1101 and 1102 (or UWRT 1103); 7 hours of approved natural sciences with 1 hour lab; 3 hours of approved social sciences - for Financial Services Informatics, ECON 2101 fulfills this requirement; LBST 1101, 1102, 1103, 1104 or 1105; LBST 2101 and 2102; ITIS 2211 (fulfills the LBST 221X requirement); ITCS 3688 fulfills the writing in the discipline and the oral communication requirement; ENGL 2116 fulfills the second writing requirement.
Related Work	0-15	May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. For Financial Services Informatics, these credits are preselected from courses in the College or Business, as shown in the APS.
Foreign Language	-	
Electives	2-5	Varies depending on concentration.
Total Credit Hours	120	

SUGGESTED PLAN OF STUDY – B.A. CONCENTRATION: FINANCIAL SERVICES INFORMATICS

Freshmen Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (with Lab)	4			
MATH 1120	Calculus	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
ITCS 1301	Introduction to the Financial Services Industry	3			
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
Spring Semester					
ITSC 1213+L	Introduction to Computer Science II (with Lab)	4			
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
STAT 1220	Elements of Statistics I	3	X		
ITSC 2175	Logic and Algorithms	3			
PHIL 1106	Critical Thinking	3			

33 Credit Hours For Year

Sophomore Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2214	Data Structures and Algorithms	3			
STAT 2223	Elements of Statistics II	3			
COMM 2105	Small Group Communication	3			
ACCT 2121	Principles of Accounting I	3			
ECON 2101	Principles of Economics - Macro	3	X		Fulfills Social Science Gen. Ed. Requirement
Spring Semester					
ITCS 2301	Financial Services Computing Environment	3			
ITIS 2300+L	Web-Based Application Development (with lab)	3			
ENGL 2116	Introduction to Technical Communication	3	X	W	Fulfills second writing requirement
ACCT 2122	Principles of Accounting II	3			
ECON 2102	Principles of Economics - Micro	3			

30 Credit Hours For Year

Junior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITIS 3200	Introduction to Information Security and Privacy	3			
ITCS 3301	Intro. to Regulatory Environment for Financial Services Firms	3			
LBST 2102	Global and Intercultural Connections	3	X		
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221x Gen. Ed. Requirement
FINN 3120	Financial Management	3			
Spring Semester					
ITSC 3155	Software Engineering	3			
ITIS 3300	Software Requirements and Project Management	3			
ITCS 4640	FSI Industry Foundations Capstone I	3			
FINN 3221	Financial Institutions and Markets	3			
XXXX XXXX	Free Elective	2			

29 Credit Hours For Year

Senior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITCS 3160	Data Base Design and Implementation	3			
ITIS 3130	Human-Computer Interaction	3			
ITCS 4641	FSI Industry Foundations Capstone II	3			
FINN 3326	Financial Theory and Practice	3			
XXXX XXXX	Natural Science (General Education Requirement)	3	X		
Spring Semester					
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills writing in discipline
ITIS 4220	Vulnerability Assessment and Systems Assurance	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		

28 Credit Hours For Year

SUGGESTED PLAN OF STUDY – B.A. CONCENTRATION: HUMAN-COMPUTER INTERACTION

Freshmen Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (with lab)	4			
MATH 1120	Calculus	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
Spring Semester					
ITSC 1213+L	Introduction to Computer Science II (with lab)	4			
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
STAT 1220	Elements of Statistics I	3	X		
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		

31 Credit Hours For Year

Sophomore Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2214	Data Structures and Algorithms	3			
ITSC 2175	Logic and Algorithms	3			
STAT 2223	Elements of Statistics II	3			
XXXX XXXX	Social Science (General Education Requirement)	3	X		
LBST 2101	Western Cultural and Historical Awareness	3	X		
Spring Semester					
ITIS 3130	Human-Computer Interaction	3			
ITIS 2300+L	Web-Based Application Development (with lab)	3			
ENGL 2116	Introduction to Technical Communication	3		W	Fulfills second writing requirement
XXXX XXXX	Outside specialization (1 of 5)	3			
ITIS 2211	Ethical Issues in Personal, Professional, and Public Life	3	X		Fulfills LBST 22xx requirement

30 Credit Hours For Year

Junior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITIS 3150	Rapid Prototyping & Interface Building	3			
ITIS 3200	Introduction to Information Security and Privacy	3			
XXXX XXXX	Technical writing and communication	3		W	
XXXX XXXX	Outside specialization (2 of 5)	3			
PHIL 1106	Critical Thinking	3			
Spring Semester					
XXXX XXXX	Technical Elective	3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills writing in discipline
XXXX XXXX	Technical writing and communication	3		W	
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Outside specialization (3 of 5)	3			

30 Credit Hours For Year

Senior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITCS 3216	Introduction to Cognitive Science	3			
XXXX XXXX	Technical Elective	3			
ITIS 4180	Mobile Application Development	3			
XXXX XXXX	Technical Elective	3			
XXXX XXXX	Outside specialization (4 of 5)	3			
Spring Semester					
ITIS 4440	Interactive Systems Design and Implementation	3			
XXXX XXXX	Capstone ITCS 4155, 4232, 4650/4651, 4990 or 4991	3			
IT IS 4011	Interaction Design Studio	3			
XXXX XXXX	Free Elective	2			
XXXX XXXX	Outside specialization (5 of 5)	3			

29 Credit Hours For Year

SUGGESTED PLAN OF STUDY – B.A. CONCENTRATION: INFORMATION TECHNOLOGY

Freshmen Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (with lab)	4			
MATH 1120	Calculus	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
<i>Spring Semester</i>					
ITSC 1213+L	Introduction to Computer Science II (with lab)	4			
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
STAT 1220	Elements of Statistics I	3	X		
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		

31 Credit Hours For Year

Sophomore Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 2214	Data Structures and Algorithms	3			
ITSC 2175	Logic and Algorithms	3			
STAT 2223	Elements of Statistics II	3			
XXXX XXXX	Social Science (General Education Requirement)	3	X		
LBST 2101	Western Cultural and Historical Awareness	3	X		
<i>Spring Semester</i>					
ITIS 3130	Human-Computer Interaction	3			
ITIS 2300+L	Web-Based Application Development (with lab)	3			
ITIS 2211	Ethical Issues in Personal, Professional, and Public Life	3	X		Fulfills LBST 221xx requirement
XXXX XXXX	Technical writing and communication	3		W	
XXXX XXXX	Outside specialization (1 of 5)	3			

30 Credit Hours For Year

Junior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITCS 3160	Data Base Design and Implementation	3			
ITIS 3200	Introduction to Information Security and Privacy	3			
ITIS 3300	Software Requirements and Project Management	3			
XXXX XXXX	Technical writing and communication	3		W	
XXXX XXXX	Outside specialization (2 of 5)	3			
<i>Spring Semester</i>					
ITSC 3155	Software Engineering	3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills writing in discipline
PHIL 1106	Critical Thinking	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Outside specialization (3 of 5)	3			

30 Credit Hours For Year

Senior Year					
Course Number	Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITIS 3310	Software Architecture and Design	3			
ITIS 3320	Introduction to Software Testing and Assurance	3			
ENGL 2116	Introduction to Technical Communication	3		W	Fulfills second writing requirement
XXXX XXXX	Technical Elective	3			
XXXX XXXX	Outside specialization (4 of 5)	3			
ITIS 4420	Usable Security & Privacy	3			
<i>Spring Semester</i>					
XXXX XXXX	Capstone ITCS 4155, 4232, 4650/4651, 4990 or 4991	3			
XXXX XXXX	Technical Elective	3			
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	Free Elective	2			

29 Credit Hours For Year

ADVISING RESOURCES

- General Education Requirements for ALL Students: ucol.uncc.edu/general-education
- Undergraduate Catalog: catalog.uncc.edu
- Central Advising website: advising.uncc.edu
- College of Computing & Informatics advising website: cci.uncc.edu/students/advising
- University Advising Center website: advisingcenter.uncc.edu

~~Computer Science, Computing Systems Concentration, B.A.~~

The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21-24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A. program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

~~Degree Requirements~~

The B.A. in Computer Science requires 121 credit hours of coursework.

~~Major Courses (39 credit hours)~~

~~[ITCS 1212 – Introduction to Computer Science I \(4\)](#)~~

~~[ITCS 1212L – Programming Lab I \(0\)](#)~~

~~[ITCS 1213 – Introduction to Computer Science II \(4\)](#)~~

~~[ITCS 1213L – Programming Lab II \(0\)](#)~~

~~[ITCS 1600 – Computing Professionals \(1\)](#)~~

~~[ITCS 2175 – Logic and Algorithms \(3\)](#)~~

~~[ITCS 2214 – Data Structures \(3\)](#)~~

~~[ITCS 2215 – Design and Analysis of Algorithms \(3\)](#)~~

~~[ITCS 3146 – Operating Systems and Networking \(3\)](#)~~

~~[ITCS 3155 – Software Engineering \(3\)](#)~~

~~[ITCS 3160 – Database Design and Implementation \(3\)](#)~~ ~~[ITCS](#)~~

~~[3688 – Computers and Their Impact on Society \(3\)](#)~~ ~~[ENGL](#)~~

~~[2116 – Introduction to Technical Communication \(3\)](#)~~

~~[ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3\)](#)~~

~~[PHIL 1106 – Critical Thinking \(3\)](#)~~

~~Mathematics and Statistics Courses (12 credit hours)~~

Select one of the following groups of courses:

Group 1

- ~~[MATH 1120 – Calculus \(3\)](#)~~
- ~~[MATH 2164 – Matrices and Linear Algebra \(3\)](#)~~
- ~~[STAT 1220 – Elements of Statistics I \(BUSN\) \(3\)](#)~~
- ~~[STAT 2223 – Elements of Statistics II \(3\)](#)~~

Group 2

- ~~[MATH 1241 – Calculus I \(3\)](#)~~
- ~~[MATH 1242 – Calculus II \(3\)](#)~~
- ~~[MATH 2164 – Matrices and Linear Algebra \(3\)](#)~~
- ~~[STAT 2122 – Introduction to Probability and Statistics \(3\)](#)~~

Concentration Courses (12 credit hours)

Select four of the following:

- ~~[ITCS 3110 – Compiler Construction \(3\)](#)~~
- ~~[ITCS 3112 – Design and Implementation of Object Oriented Systems \(3\)](#)~~
- ~~[ITCS 3143 – Operating Systems \(3\)](#)~~
- ~~[ITCS 3166 – Introduction to Computer Networks \(3\)](#)~~
- ~~[ITCS 4145 – Parallel Computing \(3\)](#)~~
- ~~[ITCS 4181 – Microcomputer Interfacing \(3\)](#)~~

Additional Degree Requirements

Capstone Experience (3 credit hours)

Select one of the following:

- ~~[ITCS 4155 – Software Development Projects \(3\)](#)~~
- ~~[ITCS 4232 – Game Design and Development Studio \(3\)](#)~~
- ~~[ITCS 4650 – Senior Project I \(3\)](#)~~
- ~~[ITCS 4651 – Senior Project II \(3\)](#)~~
- ~~[ITCS 4990 – Undergraduate Research \(3\)](#)~~
- ~~[ITCS 4991 – Undergraduate Thesis \(3\)](#)~~

Outside Concentration (15 credit hours)

A component of 15 credit hours of approved non-computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000-level or above, plus an additional 9 hours of approved non-ITCS courses, forming an integrated program of secondary strength.

Business Outside Concentration

Consists of a prescribed set of courses from the College of Business and one 3000 level course from a restricted set of choices. CCI-04-12-2015

Mathematics Outside Concentration

Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.

Technical Electives (6 credit hours)

Students select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Computer Science, Financial Services Informatics Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas. The focus of these concentrations includes:

- Human-Computer Interaction
- Information Technology
- Financial Services Informatics

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The [Concentration in Information Technology](#) emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The [Concentration in Human-Computer Interaction](#) emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking ([PHIL 1106](#)) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the [LBST 2211](#) and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1120 - Calculus (3 credits)
- STAT 1220 - Elements of Statistics I (3 credits)

Inquiry into the Sciences (10 Credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- ECON 2101 - Principles of Economics Macro (Satisfies Social Science General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 Credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) - Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (27 credit hours)

Critical Thinking (3 credits)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (3 credits)

- STAT 2223 - Elements of Statistics II (3 credits)

Core Courses (15 credits)

All concentrations in the B.A. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)

Capstone Courses (6 Credit hours)

- ITCS 4640 - FSI Industry Foundations Capstone I (3 credits)
- ITCS 4641 - FSI Industry Foundations Capstone II (3 credits)

Financial Services Informatics Concentration (51 Credit hours)

- ITCS 1301 - Introduction to the Financial Services Industry (3 credits)
- ACCT 2121 - Principles of Accounting I (3 credits)
- ECON 2101 - Principles of Economics - Macro (3 credits)
- ITCS 2301 - Financial Services Computing Environment (3 credits)
- ITIS 2300+L - Web-Based Application Development (plus lab) (3 credits)
- ACCT 2122 - Principles of Accounting II (3 credits)
- ECON 2102 - Principles of Economics - Micro (3 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITCS 3301 - Intro. to Regulatory Environment for Financial Services Firms (3 credits)
- FINN 3120 - Financial Management (3 credits)
- ITSC 3155 - Software Engineering (3 credits)
- ITIS 3300 - Software Requirements and Project Management (3 credits)
- FINN 3221 - Financial Institutions and Markets (3 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 3130 - Human-Computer Interaction (3 credits)
- FINN 3326 - Financial Theory and Practice (3 credits)
- ITIS 4220 - Vulnerability Assessment and Systems Assurance (3 credits)

Free Electives Courses (2 Credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Human-Computer Interaction Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas. The focus of these concentrations includes:

- Human-Computer Interaction
- Information Technology
- Financial Services Informatics

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The Concentration in Information Technology emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The Concentration in Human-Computer Interaction emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking ([PHIL 1106](#)) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the [LBST 2211](#) and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1120 - Calculus (3 credits)
- STAT 1220 - Elements of Statistics I (3 credits)

Inquiry into the Sciences (10 Credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 Credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) - Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (39 credit hours)

Core Courses (15 credit hours)

All concentrations in the B.A. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)

- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)

Critical Thinking (3 credits)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (3 credits)

- STAT 2223 - Elements of Statistics II (3 credits)

Related Area (15 Credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 Credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Human-Computer Interaction Concentration Courses (39 Credit hours)

Core Courses (24 Credit hours)

- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITIS 2300+L - Web-Based Application Development (plus lab) (3 credits)
- ITIS 3150 - Rapid Prototyping & Interface Building (3 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITCS 3216 - Introduction to Cognitive Science (3 credits)
- ITIS 4011 - Interaction Design Studio (3 credits)
- ITIS 4180 - Mobile Application Development (3 credits)
- ITIS 4440 - Interactive Systems Design and Implementation (3 credits)

Writing Courses (6 Credit hours)

This concentration requires an additional 6 credits in writing intensive courses. This requirement may be satisfied using any one of many intensive writing courses available at the university.

Technical Electives Courses (9 Credit hours)

Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics, excluding the courses listed above.

Free Electives Courses (2 Credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Information Technology Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas. The focus of these concentrations includes:

- Human-Computer Interaction
- Information Technology
- Financial Services Informatics

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The Concentration in Information Technology emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The Concentration in Human-Computer Interaction emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking ([PHIL 1106](#)) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the [LBST 2211](#) and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

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- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1120 - Calculus (3 credits)
- STAT 1220 - Elements of Statistics I (3 credits)

Inquiry into the Sciences (10 Credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 Credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (39 credit hours)

Core Courses (15 credit hours)

All concentrations in the B.A. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)

Critical Thinking (3 credits)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (3 credits)

- STAT 2223 - Elements of Statistics II (3 credits)

Related Area (15 Credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 Credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Information Technology Concentration Courses (39 Credit hours)

Core Courses (27 Credit hours)

- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITIS 2300+L - Web-Based Application Development (plus lab) (3 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITIS 3300 - Software Requirements and Project Management (3 credits)
- ITSC 3155 - Software Engineering (3 credits)
- ITIS 3310 - Software Architecture and Design (3 credits)
- ITIS 3320 - Introduction to Software Testing and Assurance (3 credits)
- ITIS 4420 - Usable Security & Privacy (3 credits)

Writing Courses (6 Credit hours)

This concentration requires an additional 6 credits in writing intensive courses. This requirement may be satisfied using any one of many intensive writing courses available at the university.

- XXXX XXXX - Technical writing and communication (3 credits)
- XXXX XXXX - Technical writing and communication (3 credits)

Technical Electives Courses (6 Credit hours)

Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics, excluding the courses listed above.

Free Electives Courses (2 Credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).



Student Learning Outcomes Assessment Plan

College: Computing and Informatics

Department: Computer Science

**Name of Degree or Certificate Program/Stand Alone Minor/Online Distance Education Program:
Bachelor of Arts in Computer Science**

Student Learning Outcome 1 (knowledge, skill or ability to be assessed)

- 1) Students will demonstrate acceptable **oral and written communication** skills.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Oral presentations and Written Topic Paper in **ITCS 3688 Computers and Their Impact on Society**. The students will be assessed during their presentation on their ability to introduce a topic as well as summarize main points. Other aspects to be assessed are pacing, voice, eye contact, poise, and use of gestures. The students will be assessed on their overall organization, grasp of content knowledge, use of proper grammar and spelling, ability to reach a justified conclusion, and use of proper citations in the written paper.

SLO1a_Instructions_Oral Presentation-BSBA

SLO1b_Instructions_Writing Assignment-BSBA

SLO1a_Rubric_Oral Presentation-BSBA

SLO 1b_Rubric Writing Assignment-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The instructor will grade students' oral communication skills using an oral communication skill scoring rubric [*SLO1a_Rubric_Oral Presentation-BSBA*] and a written communication skill scoring rubric [*SLO1b_Rubric_Writing_Assignment-BSBA*] with a scale of 1-5. The assessment will be performed by the **ITCS 3688** instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed,

the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve “Acceptable” or higher level (average score 3.0~5.0 on the rubric elements) in the oral communication skills portion of the presentation grade and in the written communication portion of the grade in **ITCS 3688**.

Student Learning Outcome 2
(knowledge, skill or ability to be assessed)

2) Students will demonstrate acceptable **teamwork** skills.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Teamwork score on **ITSC 3155 Software Engineering** group project - every Spring semester, the instructors of ITSC 3155 will assign a group project and a component of the project grade will be on each individual team member's teamwork skills. The students will be assessed on their ability to contribute to team meetings; facilitate the contributions of other team members; work independently and responsibly to make contributions outside of actual team meetings; aid in the creation of a constructive team environment; and deal with conflict.

SLO2_Rubric_Teamwork Skills-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. This skill will be graded using a scoring rubric [*SLO2_Rubric_Teamwork Skills-BSBA*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the individual teamwork portion of the group project in **ITSC 3155**.

Student Learning Outcome 3
(knowledge, skill or ability to be assessed)

3) Students will demonstrate acceptable **knowledge of professional and ethical** responsibilities.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A peer-reviewed paper relating to ethics in **ITCS 3688 Computers and Their Impact on Society**. The students are given a professional situation that has at least one embedded ethical dilemma. The students will be assessed on their overall organization, grasp of ethical issues, use of proper grammar and spelling, ability to reach a justified conclusion, and use of proper citations.

SLO3_Instructions_Ethics Paper-BSBA

SLO3_Rubric_Ethics Paper-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

A peer-reviewed paper relating to ethics will be graded by the **ITCS 3688** instructor using a scoring rubric [*SLO3_Rubric_Ethics Paper-BSBA*] for knowledge of professional and ethical responsibilities with a scale of 1-5. The assessment will be performed by the **ITCS 3688** instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) on peer-reviewed paper relating to ethics in **ITCS 3688**.

Student Learning Outcome 4
(knowledge, skill or ability to be assessed)

4) Students will demonstrate competence in **programming skills**.

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Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A substantial programming project in **ITSC 1213 Introduction to Computer Science II**, which requires the student to demonstrate the ability to design and implement a software solution (program) using programming skills. The students are assessed on their thorough understanding of requirements; use of appropriate data structures and algorithms; solution design and modularization; user interface considerations; testing for correctness; and documentation.
SLO4 Rubric Programming Project-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. The instructors of **ITSC 1213 Introduction to Computer Science II** will assign the project and grade a student's programming skills using a programming skill scoring rubric [*SLO4 Rubric Programming Project-BSBA*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the programming skills demonstrated in **ITSC 1213** programming project.

This concludes the SLOs for the BA Degree in Computer Science. The Following SLOs are for the 3 concentrations offered within this degree program.

Student Learning Outcome 6a: Financial Services
(knowledge, skill or ability to be assessed)

6a) Students will demonstrate competence in applying financial technologies and tools to integrate technical and financial knowledge to provide solutions in financial services.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A substantial programming project in **ITCS 2301 Financial Services Computing Environment**, which requires the student to develop a software solution to a problem from the 'Financial Services' area. The students are assessed on their ability to investigate the problem, analyze various approaches, implement a design, design a test regimen, code, test, and document their solution.

SLO6a-BA_Instructions_Financial Services Project

SLO6a-BA_Rubric_Financial Services Project

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. The instructors of **ITCS 2301** will assign the project and grade a student's skills using a scoring rubric [*SLO6a-BA_Rubric_Financial Services Project*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee

will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the financial services project.

Student Learning Outcome 6b: Human Computing and Interaction (knowledge, skill or ability to be assessed)

6b) Students will demonstrate knowledge of [human computer interaction design concepts and related methodologies](#).

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A substantial programming project in **ITIS 3130 Human-Computer Interaction**, which requires the student to demonstrate the ability to implement a software design solution. The students are assessed on their thorough understanding of requirements; application of design goals, prototyping, evaluation methodology and analysis.

SLO6b-BA_Rubric_HCIDesignProject

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. The instructors of **ITIS 3130** will assign the project and grade a student's HCI design skills using a project skill scoring rubric [*SLO6b-BA_Rubric_HCIDesignProject*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

80% of students will achieve “Acceptable” or higher level (average score 3.0~5.0 on the rubric elements) in the HCI design project.

Student Learning Outcome 6c: Information Technology (knowledge, skill or ability to be assessed)

6c) Students will demonstrate [the ability to combine hardware and software to create an IT infrastructure](#).

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Student teams in **ITIS 3310 Software Architecture and Design** will identify, define, and implement an IT infrastructure. The project will be judged in the following areas: completeness of proposal, solution design, appropriate integration of hardware and protocols, teamwork, project documentation. Infrastructure project guidelines are provided to the students.

SLO6c-BA_IT_Concentration_Rubric

SLO6c-BA_IT_Concentration_Instructions

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The IT infrastructure project will be graded by the course instructor each spring semester that **ITIS 3310** is taught. A rubric will be used to score student group performance on a scale of 1 to 5 across the multiple skill areas described above in the Effectiveness Measure. After collecting data, the instructors will report results, comments and suggestions for improvements to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets by submitting a report to the Department Chair, the Assistant Chair, and the College’s Associate Dean for Administration, copying each affected instructor. The Assistant Chair will coordinate with instructors to ensure that deficient areas are corrected and suggested changes are implemented. The Assistant Chair will be responsible for generating the Final Assessment Report and gaining approval for the Report from the Department Chair and the College’s Associate Dean for Administration.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

At least 80% of students will score at or above “Developing” (i.e., a 3 on the scoring rubric) on each of the project skill areas.





PROGRAM SUMMARY

- **Credit Hours:** 120 hours
- **Concentrations:** AI, Robotics & Gaming; Bioinformatics; Cyber Security; Data Science; Software, Systems & Networks; Software Engineering; Web & Mobile Applications
- **Declaring the Major:** Minimum GPA of 2.5 required; no pre-requisite courses; change of major form accepted year-round; advising session required after declaration
- **Advising (For the Major):** Required on admission to the major and before each semester, assigned advisors available by appointment
- **Advising (For General Education):** Required on admission to the major and before each semester, assigned advisors available by appointment
- **Minimum Grades/GPA:** GPA of 2.0 in the major required for graduation
- **Teacher Licensure:** No
- **Evening Classes Available:** Some
- **Weekend Classes Available:** No
- **Other Information:** Freshman Learning Community, CCI Honors, Internships, Co-ops, Graduate Early Entry

Contact(s): For the concentrations AI, Robotics & Gaming; Data Science; or Software, Systems, & Networks: James Frazier, Assistant Chair and Undergraduate Coordinator, Department of Computer Science, Woodward Hall 410-B, 704-687-8557, jfrazier2@uncc.edu; for the concentrations Cyber Security, Software Engineering, Web & Mobile Applications, Bruce Long, Assistant Chair and Director of Undergraduate Programs, Department of Software and Information Systems, 704-687-8441, nblong@uncc.edu, Woodward Hall 310-E; for the Bioinformatics concentration: Dr. Jun-tao Guo, Associate Professor, Department of Bioinformatics and Genomics, 704-687-7492, jguo4@uncc.edu, Bioinformatics 359.

PROGRAM REQUIREMENTS

The B.S. in Computer Science is a relatively structured degree with seven different concentrations. The degree has 25 hours of core Computer Science courses, a series of courses to choose from as major electives, and 9-15 semester hours of related work in a discipline outside computer science, possibly forming a minor in that discipline area. The program begins with a series of courses that are generally prerequisites for upper level courses. Due to the large number of major requirements it is recommended that students declare the major in their freshman year and the concentration in their sophomore year to complete their degree on time.

Areas	Credit Hours	Description
Pre-Major/ Prerequisites		
Major	58-67	Computer Science Core 25 hours - ITSC 1212/L, ITSC 1213/L, ITSC 1600, ITSC 2175, ITSC 2214, ITSC 3146, ITSC 3155, ITSC 3181/L; Computer Science Concentration one of seven concentration areas: AI, Robotics & Gaming; Bioinformatics; Cyber Security; Data Science; Software, Systems & Networks; Software Engineering; Web & Mobile Applications; Major Electives 0-6 hours depending on concentration - Must be at the 3000 level or above and in the College of Computing and Informatics; Capstone 3 hours. Communication 6 hours – ENGL 2116, PHIL 1106; Analytic 12 hours - MATH 1241, 1242, 2164, and STAT 2122.
General Education (not satisfied by other major requirements)	37-40	UWRT 1101 and 1102 (or UWRT 1103); 7 hours of approved sciences with 1 lab; 3 hours of approved social sciences; LBST 1101, 1102, 1103, 1104 or 1105; LBST 2101 and 2102; ITIS 2211 (fulfills LBST 221X General Education Requirement)
Related Work	9-15	May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.
Foreign Language	-	
Electives	1-11	Varies depending on concentration
Total Credit Hours	120	

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: AI, ROBOTICS & GAMING**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1212+L	Introduction to Computer Science I (with Lab)	4			
ITSC 1600	Computing Professionals	1			
PHIL 1106	Critical Thinking	3			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
Spring Semester					
ITSC 1213+L	Introduction to Computer Science II (with Lab)	4			
ITSC 2175	Logic and Algorithms	3			
MATH 1242	Calculus II	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		

33 Credit Hours for Year**Sophomore Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2214	Data Structures and Algorithms	3			
STAT 2122	Introduction to Probability and Statistics	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
XXXX XXXX	Outside specialization (1 of 5)	3			
ENGL 2116	Introduction to Technical Communication	3	X	W	
Spring Semester					
ITCS 3153	Intro to Artificial Intelligence	3			
MATH 2164	Matrices and Linear Algebra	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
XXXX XXXX	Outside specialization (2 of 5)	3			

31 Credit Hours for Year**Junior Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 3181+L	Introduction to Computer Architecture (with Lab)	4			
ITSC 3155	Software Engineering	3			
XXXX XXXX	AIRG Concentration Elective	3			
XXXX XXXX	Outside specialization (3 of 5)	3			
XXXX XXXX	Social Science	3	X		
Spring Semester					
ITSC 3146	Operating Systems and Networking	3			
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
XXXX XXXX	AIRG Concentration Elective	3			
XXXX XXXX	Outside specialization (4 of 5)	3			

31 Credit Hours for Year**Senior Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	AIRG Concentration Elective	3			
XXXX XXXX	AIRG Concentration Elective	3			
XXXX XXXX	Technical Elective: ITCS/ITIS 3XXX or above	3			
XXXX XXXX	Free Elective	1			
Spring Semester					
ITCS 4XXX	CS Capstone: ITCS 4155, 4232, 4238, 4650/4651, 4990 or 4991	3			
XXXX XXXX	AIRG Concentration Elective	3			
XXXX XXXX	Free Elective	3			
XXXX XXXX	Free Elective	3			

25 Credit Hours for Year

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: BIOINFORMATICS**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1212/L	Introduction to Computer Science I (with Lab)	4			
ITSC 1600	Computing Professionals	1			
PHIL 1106	Critical Thinking	3			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
Spring Semester					
ITSC 1213/L	Introduction to Computer Science II (with Lab)	4			
XXXX XXXX	Natural Science (General Education Requirement)	3	X		
MATH 1242	Calculus II	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
BINF 1101/L	Introduction to Bioinformatics and Genomics	4	X		Fulfills Natural Science + Lab
34 Credit Hours for Year					

Sophomore Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
BINF 2111/L	Introduction to Bioinformatics Computing	4			
STAT 2122	Introduction to Probability and Statistics	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
ENGL 2116	Introduction to Technical Communication	3	X	W	
XXXX XXXX	Social Science (General Education Requirement)	3	X		
Spring Semester					
MATH 2164	Matrices and Linear Algebra	3			
LBST 2102	Global and Intercultural Connections	3	X		
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITSC 2214	Data Structures and Algorithms	3			
XXXX XXXX	Outside specialization (1 of 5)	3			
31 Credit Hours for Year					

Junior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2175	Logic and Algorithms	3			
BINF 3101/L	Sequence Analysis	3			
ITSC 3155	Software Engineering	3			
XXXX XXXX	Outside Specialization (2 of 5)	3			
XXXX XXXX	Outside Specialization (3 of 5)	3			
Spring Semester					
BINF XXXX	Choose 1 from BINF3121, BINF3211, or BINF4211	3			
BINF XXXX	Choose 1 from BINF3201/L, BINF4101, or BINF4111	4/3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
XXXX XXXX	Outside Specialization (4 of 5)	3			
XXXX XXXX	Outside Specialization (5 of 5)	3			
31/30 Credit Hours for Year					

Senior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 3181/L	Introduction to Computer Architecture (with Lab)	4			
BINF XXXX	Choose 1 from BINF4171 or BINF4191	3			
XXXX XXXX	Free Elective	3			
XXXX XXXX	Free Elective	3			
Spring Semester					
ITSC 3146	Operating Systems and Networking	3			
BINF 4600	Bioinformatics Seminar	1			
XXXX XXXX	Capstone BINF 4650 or ITCS 4991	3			
XXXX XXXX	Free Elective	3			
XXXX XXXX	Free Elective	1/2			
24/25 Credit Hours for Year					

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: CYBER SECURITY**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (plus lab)	4			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
<i>Spring Semester</i>					
ITSC 1213+L	Introduction to Computer Science II (plus Programming Lab II)	4			
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
MATH 1242	Calculus II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		
31 Credit Hours for Year					

Sophomore Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 2175	Logic and Algorithms	3			
ITIS 2300+L	Web-Based Application Development (plus lab)	3			
ITSC 2214	Data Structures and Algorithms	3			
MATH 2164	Matrices and Linear Algebra	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
<i>Spring Semester</i>					
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITSC 3146	Operating Systems and Networks	3			
STAT 2122	Introduction to Probability and Statistics	3			
ENGL 2116	Introduction to Technical Communication	3		W	
XXXX XXXX	Outside specialization (1 of 5)	3			
30 Credit Hours for Year					

Junior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITIS 3200	Introduction to Information Security and Privacy	3			
ITIS 3130	Human-Computer Interaction	3			
ITSC 3155	Software Engineering	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Outside specialization (2 of 5)	3			
<i>Spring Semester</i>					
ITSC 3181+L	Introduction to Computer Architecture (with Lab)	4			
ITIS 3110+L	IT Infrastructure: Design and Practice	3			
ITCS 3160	Data Base Design and Implementation	3			
XXXX XXXX	Social Science (General Education Requirement)	3	X		
XXXX XXXX	Outside specialization (3 of 5)	3			
31 Credit Hours for Year					

Senior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITIS 4250	Computer Forensics	3			
ITIS 4166	Network-Based Application Development	3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
PHIL 1106	Critical Thinking	3			
XXXX XXXX	Outside specialization (4 of 5)	3			
<i>Spring Semester</i>					
ITIS 4221	Secure Programming and Penetration Testing	3			
ITIS 4420	Usable Security & Privacy	3			
ITCS XXXX	Capstone ITCS 4155, 4650/4651, 4990 or 4991	3			
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	Free Elective	1			
28 Credit Hours for Year					

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: DATA SCIENCE**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1212/L	Introduction to Computer Science I (with Lab)	4			
ITSC 1600	Computing Professionals	1			
PHIL 1106	Critical Thinking	3			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
LBST 110X	The Arts and Society	3	X		
Spring Semester					
ITSC 1213/L	Introduction to Computer Science II (with Lab)	4			
ITSC 2175	Logic and Algorithms	3			
MATH 1242	Calculus II	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		

33 Credit Hours for Year**Sophomore Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2214	Data Structures and Algorithms	3			
STAT 2122	Introduction to Probability and Statistics	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
XXXX XXXX	Outside specialization (1 of 5)	3			
ENGL 2116	Introduction to Technical Communication	3	X	W	
Spring Semester					
ITCS 3160	Data Base Design and Implementation	3			
MATH 2164	Matrices and Linear Algebra	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
XXXX XXXX	Outside specialization (2 of 5)	3			

31 Credit Hours for Year**Junior Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 3181/L	Introduction to Computer Architecture (with Lab)	4			
ITSC 3155	Software Engineering	3			
ITCS 3162	Intro to Data Mining	3			
XXXX XXXX	Outside specialization (3 of 5)	3			
XXXX XXXX	Social Science	3	X		
Spring Semester					
ITSC 3146	Operating Systems and Networking	3			
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITCS 3688	Computers and Their Impact on Society	3	X	W,O	Fulfills second writing requirement
XXXX XXXX	DS Concentration Elective	3			
XXXX XXXX	Outside specialization (4 of 5)	3			

31 Credit Hours for Year**Senior Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	DS Concentration Elective	3			
XXXX XXXX	Technical Elective: ITCS/ITIS 3XXX or above	3			
XXXX XXXX	Technical Elective: ITCS/ITIS 3XXX or above	3			
XXXX XXXX	Free Elective	1			
Spring Semester					
ITCS 4XXX	CS Capstone: ITCS 4155, 4650, or 4990	3			
XXXX XXXX	DS Concentration Elective	3			
XXXX XXXX	Free Elective	3			
XXXX XXXX	Free Elective	3			

25 Credit Hours for Year

SUGGESTED PLAN OF STUDY –B.S. IN COMPUTER SCIENCE: SOFTWARE ENGINEERING**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (plus lab)	4			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
<i>Spring Semester</i>					
ITSC 1213+L	Introduction to Computer Science II (plus Programming Lab II)	4			
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
MATH 1242	Calculus II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		
					31 Credit Hours for Year

Sophomore Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 2175	Logic and Algorithms	3			
ITIS 2300+L	Web-Based Application Development (plus lab)	3			
ITSC 2214	Data Structures and Algorithms	3			
MATH 2164	Matrices and Linear Algebra	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
<i>Spring Semester</i>					
ITIS 2211	Ethical Issues in Personal, Professional, and Public Life	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITSC 3146	Operating Systems and Networks	3			
STAT 2122	Introduction to Probability and Statistics	3			
ENGL 2116	Introduction to Technical Communication	3		W	
XXXX XXXX	Outside specialization (1 of 5)	3			
					30 Credit Hours for Year

Junior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 3181+L	Introduction to Computer Architecture (with Lab)	4			
ITIS 3200	Introduction to Information Security and Privacy	3			
ITIS 3130	Human-Computer Interaction	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Outside specialization (2 of 5)	3			
<i>Spring Semester</i>					
ITSC 3155	Software Engineering	3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
ITCS 3160	Data Base Design and Implementation	3			
XXXX XXXX	Social Science (General Education Requirement)	3	X		
XXXX XXXX	Outside specialization (3 of 5)	3			
					31 Credit Hours for Year

Senior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITIS 3300	Software Requirements and Project Management	3			
ITIS 3310	Software Architecture and Design	3			
ITIS 3320	Introduction to Software Testing and Assurance	3			
ITIS 4166	Network-Based Application Development	3			
XXXX XXXX	Outside specialization (4 of 5)	3			
<i>Spring Semester</i>					
ITIS 4221	Secure Programming and Penetration Testing	3			
ITCS XXXX	Capstone ITCS 4155, 4650/4651, 4990 or 4991	3			
PHIL 1106	Critical Thinking	3			
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	Free Elective	1			
					28 Credit Hours for Year

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: SOFTWARE, SYSTEMS, AND NETWORKS

Freshman Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 1212/L	Introduction to Computer Science I (with Lab)	4			
ITSC 1600	Computing Professionals	1			
PHIL 1106	Critical Thinking	3			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
LBST 110X	The Arts and Society	3	X		
Spring Semester					
ITSC 1213/L	Introduction to Computer Science II (with Lab)	4			
ITSC 2175	Logic and Algorithms	3			
MATH 1242	Calculus II	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		
					33 Credit Hours for Year

Sophomore Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 2214	Data Structures and Algorithms	3			
STAT 2122	Introduction to Probability and Statistics	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
XXXX XXXX	Outside specialization (1 of 5)	3			
ENGL 2116	Introduction to Technical Communication	3	X	W	
Spring Semester					
ITCS 3166	Intro to Computer Networks	3			Required SSN course
MATH 2164	Matrices and Linear Algebra	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
XXXX XXXX	Outside specialization (2 of 5)	3			
					31 Credit Hours for Year

Junior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
ITSC 3181/L	Introduction to Computer Architecture (with Lab)	4			
ITSC 3155	Software Engineering	3			
ITCS 3145	Parallel and Distributed Computing	3			Required SSN course
XXXX XXXX	Outside specialization (3 of 5)	3			
XXXX XXXX	Social Science	3	X		
Spring Semester					
ITSC 3146	Operating Systems and Networking	3			
ITIS 2211	Ethical Issues in Personal, Prof. & Public Life: Technology	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
XXXX XXXX	SSN Concentration Elective	3			SSN Concentration
XXXX XXXX	Outside specialization (4 of 5)	3			
					31 Credit Hours for Year

Senior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
Fall Semester					
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	SSN Concentration Elective	3			SSN Concentration
XXXX XXXX	Technical Elective: ITCS/ITIS 3XXX or above	3			
XXXX XXXX	Technical Elective: ITCS/ITIS 3XXX or above	3			
XXXX XXXX	Free Elective	1			
Spring Semester					
ITCS 4XXX	CS Capstone: ITCS 4155, 4650, or 4990	3			
XXXX XXXX	SSN Concentration Elective	3			SSN Concentration
XXXX XXXX	Free Elective	3			
XXXX XXXX	Free Elective	3			
					25 Credit Hours for Year

SUGGESTED PLAN OF STUDY – B.S. IN COMPUTER SCIENCE: WEB DEVELOPMENT**Freshman Year**

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 1600	Computing Professionals	1			
ITSC 1212+L	Introduction to Computer Science I (plus lab)	4			
MATH 1241	Calculus I	3	X		
UWRT 1101	Writing and Inquiry in Academic Contexts I	3	X		
XXXX XXXX	Natural Science with Lab (General Education Requirement)	4	X		
<i>Spring Semester</i>					
ITSC 1213+L	Introduction to Computer Science II (plus Programming Lab II)	4			
LBST 110X	LBST 1100 Series: Arts and Society	3	X		
UWRT 1102	Writing and Inquiry in Academic Contexts II	3	X		
MATH 1242	Calculus II	3	X		
XXXX XXXX	Natural Science (General Education Requirement)	3	X		

31 Credit Hours for Year

Sophomore Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 2175	Logic and Algorithms	3			
ITIS 2300+L	Web-Based Application Development (plus lab)	3			
ITSC 2214	Data Structures and Algorithms	3			
MATH 2164	Matrices and Linear Algebra	3			
LBST 2101	Western Cultural and Historical Awareness	3	X		
<i>Spring Semester</i>					
ITIS 2211	Ethical Issues in Personal, Professional, and Public Life	3	X		Fulfills LBST 221X Gen. Ed. Requirement
ITSC 3146	Operating Systems and Networks	3			
STAT 2122	Introduction to Probability and Statistics	3			
ENGL 2116	Introduction to Technical Communication	3		W	
XXXX XXXX	Outside specialization (1 of 5)	3			

30 Credit Hours for Year

Junior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITSC 3181+L	Introduction to Computer Architecture (with Lab)	4			
ITIS 3200	Introduction to Information Security and Privacy	3			
ITIS 3130	Human-Computer Interaction	3			
LBST 2102	Global and Intercultural Connections	3	X		
XXXX XXXX	Outside specialization (2 of 5)	3			
<i>Spring Semester</i>					
ITSC 3155	Software Engineering	3			
ITCS 3688	Computers and Their Impact on Society	3	X	W, O	Fulfills second writing requirement
ITCS 3160	Data Base Design and Implementation	3			
XXXX XXXX	Social Science (General Education Requirement)	3	X		
XXXX XXXX	Outside specialization (3 of 5)	3			

31 Credit Hours for Year

Senior Year

Course Number	Course Title	Credit Hours	General Education	W/O Course	Notes
<i>Fall Semester</i>					
ITIS 4180	Mobile Application Development	3			
ITIS 4166	Network-Based Application Development	3			
ITIS 4440	Interactive Systems Design and Implementation	3			
XXXX XXXX	Technical Elective	3			
XXXX XXXX	Outside specialization (4 of 5)	3			
<i>Spring Semester</i>					
ITIS 4221	Secure Programming and Penetration Testing	3			
ITCS XXXX	Capstone ITCS 4155, 4650/4651, 4990 or 4991	3			
PHIL 1106	Critical Thinking	3			
XXXX XXXX	Outside specialization (5 of 5)	3			
XXXX XXXX	Free Elective	1			

28 Credit Hours for Year

ADVISING RESOURCES

- General Education Requirements for ALL Students: ucol.uncc.edu/general-education
- Undergraduate Catalog: catalog.uncc.edu
- Central Advising website: advising.uncc.edu
- College of Computing & Informatics advising website: cci.uncc.edu/students/advising
- University Advising Center website: advisingcenter.uncc.edu

Computer Science, AI, Robotics & Gaming Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI](#), [Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

For this concentration, either of the courses below could also be used to satisfy the Capstone requirement.

- ITCS 4232 Game Design & Development Studio (3 credits)
- ITCS 4238 Intelligent and Interactive System Studio (3 credits)

AI, Robotics, & Gaming Concentration: Courses (21 credit hours)

Required Course (3 credit hours)

- ITCS 3153 Intro to Artificial Intelligence (3 credits)

Concentration Electives (12 credit hours)

Choose FOUR of the following courses:

- ITCS 3134 - Digital Image Processing (3 credits)
- ITCS 3120 - Introduction to Computer Graphics (3 credits)
- ITCS 4123 - Visualization and Visual Communication (3 credits)
- ITCS 4124 - Advanced 3D Computer Graphics (3 credits)
- ITCS 4150 - Mobile Robotics (3 credits)
- ITCS 4151 - Intelligent Robotics (3 credits)
- ITCS 4152 - Computer Vision (3 credits)
- ITCS 4156 - Machine Learning (3 credits)
- ITCS 4230 - Introduction to Game Design and Development (3 credits)
- ITCS 4231 - Advanced Game Design and Development (3 credits)

Technical Electives Courses (6 credit hours)

Select electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.

Free Electives Courses (7 credit hours)

Select courses offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

~~Computer Science, Computing Systems Concentration, B.S.~~

The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.

~~Degree Requirements~~

The B.S. in Computer Science requires 120 credit hours of coursework.

~~Major Courses (58 credit hours)~~

- ~~[ITCS 1212 – Introduction to Computer Science I](#) (4)~~
- ~~[ITCS 1212L – Programming Lab I](#) (0)~~
- ~~[ITCS 1213 – Introduction to Computer Science II](#) (4)~~
- ~~[ITCS 1213L – Programming Lab II](#) (0)~~
- ~~[ITCS 1600 – Computing Professionals](#) (1)~~
- ~~[ITCS 2175 – Logic and Algorithms](#) (3)~~
- ~~[ITCS 2214 – Data Structures](#) (3)~~
- ~~[ITCS 2215 – Design and Analysis of Algorithms](#) (3)~~
- ~~[ITCS 3146 – Operating Systems and Networking](#) (3)~~
- ~~[ITCS 3155 – Software Engineering](#) (3)~~
- ~~[ITCS 3160 – Database Design and Implementation](#) (3)~~
- ~~[ITCS 3181 – Logic and Computer Systems](#) (3)~~
- ~~[ITCS 3181L – Computer Systems Lab and Recitation](#) (1)~~
- ~~[ITCS 3688 – Computers and Their Impact on Society](#) (3)~~
- ~~[ITCS 4102 – Programming Languages](#) (3)~~
- ~~[ENGL 2116 – Introduction to Technical Communication](#) (3)~~
- ~~[ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology](#) (3)~~
- ~~[MATH 1241 – Calculus I](#) (3)~~
- ~~[MATH 1242 – Calculus II](#) (3)~~
- ~~[MATH 2164 – Matrices and Linear Algebra](#) (3)~~
- ~~[PHIL 1106 – Critical Thinking](#) (3)~~
- ~~[STAT 2122 – Introduction to Probability and Statistics](#) (3)~~

~~Concentration Courses (12 credit hours)~~

Select four of the following:

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- ~~ITCS 3110—Compiler Construction (3)~~
- ~~ITCS 3112—Design and Implementation of Object Oriented Systems (3)~~
- ~~ITCS 3143—Operating Systems (3)~~
- ~~ITCS 3166—Introduction to Computer Networks (3)~~
- ~~ITCS 4145—Parallel Computing (3)~~
- ~~ITCS 4181—Microcomputer Interfacing (3)~~

Additional Degree Requirements

Capstone Experience (3 credit hours)

Select one of the following:

- ~~ITCS 4155—Software Development Projects (3)~~
- ~~ITCS 4232—Game Design and Development Studio (3)~~
- ~~ITCS 4650—Senior Project I (3)~~
- ~~ITCS 4651—Senior Project II (3)~~
- ~~ITCS 4990—Undergraduate Research (3)~~
- ~~ITCS 4991—Undergraduate Thesis (3)~~

Outside Concentration (15 credit hours)

A component of 15 credit hours of approved non-computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non-ITCS courses, forming an integrated program of secondary strength.

Business Outside Concentration

Consists of a prescribed set of courses from the College of Business and one 3000-level course from a restricted set of choices.

Mathematics Outside Concentration

Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.

Technical Electives (6 credit hours)

Students select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Computer Science, Bioinformatics Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI, Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (36 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (6 credit hours)

- Natural Science + Lab Gen Ed requirement is fulfilled by concentration course
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- BINF 4650 - Senior Project (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Bioinformatics Concentration: Courses (21-22 credit hours)

Required Courses (12 credit hours)

- BINF1101+L Introduction to Bioinformatics and Genomics (4 credits) (Fulfills the Natural Science + Lab Gen. Ed. requirement)
- BINF 2111+L Introduction to Bioinformatics Computing (4 credits)
- BINF 3101+L Sequence Analysis (3 credits)
- BINF 4600 Bioinformatics Seminar (1 credits)

Subarea 1: Database/Analytics (3 credit hours)

Choose one course from the list below

- BINF 3121 Statistics for Bioinformatics (3 credits)
- BINF 3211 Bioinformatics Database and Mining Technologies (3 credits)
- BINF 4211 Applied Data Mining for Bioinformatics (3 credits)

Subarea 2: Professional Development (3 credit hours)

Choose one course from the list below

- BINF 4171 Business of Biotechnology (3 credits)
- BINF4191 Life Sciences and the Law (3 credits)

Subarea 3: Upper Division Elective (3-4 credit hours)

Choose one course from list below

- BINF 3201+L Genomics Methods (4 credits)
- BINF 4101 Computational Systems Biology (3 credits)
- BINF 4111 Structural Bioinformatics (3 credits)

Free Electives Courses (10-11 credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Cyber Security Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI, Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Cyber Security Concentration: Courses (27 credit hours)

Required Courses (27 credit hours)

- ITIS 2300+L - Web-Based Application Development (plus lab) (4 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITIS 3110+L - IT Infrastructure: Design and Practice (4 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 4250 - Computer Forensics (3 credits)
- ITIS 4166 - Network-Based Application Development (3 credits)
- ITIS 4221 - Secure Programming and Penetration Testing (3 credits)
- ITIS 4420 - Usable Security & Privacy (3 credits)

Free Electives Courses (1 credit hour)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Data Science Concentration B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI](#), [Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Data Science Concentration (21 credit hours)

Required Courses (6 credit hours)

- ITCS 3160 Database Implementation and Design (3 credits)
- ITCS 3162 Intro to Data Mining (3 credits)

Concentration Electives (9 credit hours)

Select three courses from the list below, with at least one from each of the two groups.

Group A

- ITCS 3156 Machine Learning (3 credits)
- ITCS 3216 Intro to Cognitive Science (3 credits)
- ITCS 3190 Cloud computing (3 credits)

Group B

- ITCS 4122 Visual Analytics (3 credits)
- ITCS 3134 Image Processing (3 credits)
- INFO 3236 Business Analytics (3 credits)
- ITIS 4510 Web Mining (3 credits)

Technical Electives Courses (6 credit hours)

Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.

Free Electives Courses (7 credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Software Engineering Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI, Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Software Engineering Concentration (27 credit hours)

Required Courses (27 credit hours)

- ITIS 2300+L - Web-Based Application Development (plus lab) (3 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 3300 - Software Requirements and Project Management (3 credits)
- ITIS 3310 - Software Architecture and Design (3 credits)
- ITIS 3320 - Introduction to Software Testing and Assurance (3 credits)
- ITIS 4166 - Network-Based Application Development (3 credits)
- ITIS 4221 - Secure Programming and Penetration Testing (3 credits)

Free Electives Courses (1 credit hour)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and

service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Software, Systems, & Networks Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI](#), [Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Software, Systems, & Networks Concentration (21 credit hours)

Required Courses (6 credit hours)

- ITCS 3145 Parallel and Distributed Computing (3 credits)
- ITCS 3166 Introduction to Computer Networks (3 credits)

Concentration Electives (9 credit hours)

Choose three courses from the following list. The categories are only to indicate sub-areas of this concentration and the courses selected do not need to be within one category.

Systems

- ITCS 3143 Operating Systems (3 credits)
- ITCS 3160 Database Design and Implementation (3 credits)
- ITCS 4141 Computer Organization and Architecture (3 credits)
- ITCS 4182 - Introduction to High-Performance Computing (3 credits)
- ITIS 4221 Secure Programming and Penetration Testing (3 credits)

Software: Programming Languages Foundations and Practice

- ITCS 3110 Compiler Construction (3 credits)
- ITCS 3112 Design and Implementation of Object-Oriented Systems (3 credits)
- ITCS 4102 Programming Languages (3 credits)
- ITIS 3320 Introduction to Software Testing and Assurance (3 credits)

Pervasive, Mobile, and Embedded Computing

- ITCS 4131 Communication Network Design (3 credits)
- ITCS 4180 Mobile Application Development (3 credits)
- ITIS 4166 Network-Based Application Development (3 credits)
- ITIS 3200 Introduction to Information Security and Privacy (3 credits)

Technical Electives Courses (6 credit hours)

Select three electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.

Free Electives Courses (7 credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Web & Mobile Applications, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available: [AI](#), [Robotics & Gaming](#); [Bioinformatics](#); [Cyber Security](#); [Data Science](#); [Software Engineering](#); [Software, Systems & Networks](#); [Web & Mobile Applications](#). The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1241 - Calculus I (3 credits)
- MATH 1242 - Calculus II (3 credits)

Inquiry into the Sciences (10 credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) -
Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Web & Mobile Applications Concentration (27 credit hours)

Required Courses (24 credit hours)

- ITIS 2300+L - Web-Based Application Development (plus lab) (3 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 4180 - Mobile Application Development (3 credits)
- ITIS 4166 - Network-Based Application Development (3 credits)
- ITIS 4440 - Interactive Systems Design and Implementation (3 credits)
- ITIS 4221 - Secure Programming and Penetration Testing (3 credits)

Technical Electives Courses (3 credit hours)

Select an elective from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.

Free Electives Courses (1 credit hour)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the [University Career Center](#) section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the [University Career Center](#) for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).



Student Learning Outcomes Assessment Plan

College: Computing and Informatics

Department: Computer Science

**Name of Degree or Certificate Program/Stand Alone Minor/Online Distance Education Program:
Bachelor of Science in Computer Science**

Student Learning Outcome 1 (knowledge, skill or ability to be assessed)

1) Students will demonstrate acceptable **oral and written communication** skills.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Oral presentations and Written Topic Paper in **ITCS 3688 Computers and Their Impact on Society**. The students will be assessed during their presentation on their ability to introduce a topic as well as summarize main points. Other aspects to be assessed are pacing, voice, eye contact, poise, and use of gestures. The students will be assessed on their overall organization, grasp of content knowledge, use of proper grammar and spelling, ability to reach a justified conclusion, and use of proper citations
SLO1a_Instructions_Oral Presentation-BSBA *SLO1b_Instructions_Writing Assignment-BSBA*
SLO1a_Rubric_Oral Presentation-BSBA *SLO1b_Rubric_Writing Assignment-BSBA*

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The instructor will grade students' oral communication skills using an oral communication skill scoring rubric [*SLO1a_Rubric_Oral Presentation-BSBA*] and a written communication skill scoring rubric [*SLO1b_Rubric_Writing Assignment-BSBA*] with a scale of 1-5. The assessment will be performed by the ITCS 3688 instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected

instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve “Acceptable” or higher level (average score 3.0~5.0 on the rubric elements) in the oral communication skills portion of the presentation grade in ITCS 3688.

Student Learning Outcome 2
(knowledge, skill or ability to be assessed)

2) Students will demonstrate acceptable **teamwork** skills.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Teamwork score on **ITSC 3155 Software Engineering** group project - every Spring semester, the instructors of ITSC 3155 will assign a group project and a component of the project grade will be on each individual team member's teamwork skills. The students will be assessed on their ability to contribute to team meetings; facilitate the contributions of other team members; work independently and responsibly to make contributions outside of actual team meetings; aid in the creation of a constructive team environment; and deal with conflict.

SLO2_Rubric_Teamwork Skills-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. This skill will be graded using a scoring rubric [*SLO2_Rubric_Teamwork Skills-BSBA*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the individual teamwork portion of the group project in ITSC 3155.

Student Learning Outcome 3
(knowledge, skill or ability to be assessed)

3) Students will demonstrate acceptable **knowledge of professional and ethical** responsibilities.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A peer-reviewed paper relating to ethics in **ITCS 3688 Computers and Their Impact on Society**. The students are given a professional situation that has at least one embedded ethical dilemma. The students will be assessed on their overall organization, grasp of ethical issues, use of proper grammar and spelling, ability to reach a justified conclusion, and use of proper citations.

SLO3_Instructions_Ethics Paper-BSBA

SLO3_Rubric_Ethics Paper-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

A peer-reviewed paper relating to ethics will be graded by the ITCS 3688 instructor using a scoring rubric [*SLO3_Rubric_Ethics Paper-BSBA*] for knowledge of professional and ethical responsibilities with a scale of 1-5. The assessment will be performed by the ITCS 3688 instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) on peer-reviewed paper relating to ethics in ITCS 3688.

Student Learning Outcome 4 (knowledge, skill or ability to be assessed)

4) Students will demonstrate competence in **programming skills**.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired

knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A substantial programming project in **ITSC 1213 Introduction to Computer Science II**, which requires the student to demonstrate the ability to design and implement a software solution (program) using programming skills. The students are assessed on their thorough understanding of requirements; use of appropriate data structures and algorithms; solution design and modularization; user interface considerations; testing for correctness; and documentation.

SLO4 Rubric Programming Project-BSBA

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

This outcome goal will be measured every Spring semester. The instructors of ITSC 1213 Introduction to Computer Science II will assign the project and grade a student's programming skills using a programming skill scoring rubric [*SLO4_Rubric_Programming Project-BSBA*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the programming skills demonstrated in ITSC 1213 programming project.

Student Learning Outcome 5
(knowledge, skill or ability to be assessed)

5) Students will demonstrate an ability to **analyze a problem, identify and define the computing requirements appropriate to its solution, and develop an efficient software solution** for the problem.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Capstone project/research - all CS majors are required to complete a capstone project/research/internship, which includes options of ITCS 4155 Software Development Projects or ITCS 4232 Game Design & Development Studio or ITCS 4650/4651 Senior Project or ITCS-4990 Undergraduate Research or ITCS 4991 Undergraduate Thesis. The students are assessed on their ability to design a complete solution from client requirements all the way through testing and delivery – including thorough problem analysis, identification of computing requirements, and development of an effective software solution.

SLO5BS Rubric Capstone Project

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

Each Spring, this SLO goal will be measured by all the instructors and advisors involved in capstone research/project using a scoring rubric [*SLO5BS_Rubric_Capstone Project*] with a scale of 1-5. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected. *Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.*

80% of students will achieve "Acceptable" or higher level (average score 3.0~5.0 on the rubric elements) in the capstone project/research.

This concludes the SLOs for the BS Degree in Computer Science. The Following SLOs are for the 7 concentrations offered within this degree program.

Student Learning Outcome 6a: Bioinformatics
(knowledge, skill or ability to be assessed)

SLO 6a: Students will demonstrate knowledge of the data and computational tools and procedures used in the field of bioinformatics.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

SLO 6A will be assessed using exam/quiz questions administered as part of the BINF 4600 Bioinformatics Seminar course. This course is a required capstone for the Bioinformatics and Genomics Undergraduate concentration. The questions in the attached SLO6a_questionbank document will be evaluated annually to insure they assess current bioinformatics data and tools as are taught in the required courses of the concentration. These questions will directly assess the students' recognition of data formats, sources of data, and computational tools. *(SLO6a-BS Bioinformatics questionbank.docx)*

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The assessment will be performed by the instructor every spring semester using a total of ten questions from the SLO-6a question bank given during 3 or more exams/quizzes administered to students in the BINF 4600 Bioinformatics Seminar course during the semester.

At the end of each spring semester, the instructor of record for BINF 4600 will collect these questions and responses. After removing student identifying information, the instructor of record will submit these questions to the chair of the Bioinformatics and Genomics Undergraduate Curriculum Committee (BiG-UGCC) who will analyze the results using descriptive statistics and present the data at the first Bioinformatics and Genomics Faculty meeting the following semester. The Faculty will evaluate results, identify areas for improvement, and suggest changes to achieve performance targets. The BiG-UGCC chair will document required changes in a report submitted to the Department Chair and the College's Associate Dean for Administration, copying each affected instructor. The BiG-UGCC chair will coordinate with instructors to ensure that deficient areas are corrected and suggested changes are implemented. The BiG-UGCC chair will be responsible for generating the Final Assessment Report and gaining approval for the Report from the Department Chair and the College's Associate Dean for Administration. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee's comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

80% of the students assessed will correctly answer 7 or more of the 10 SLO 6a assessment questions.

Student Learning Outcome 6b: AI, Robotics, & Gaming (knowledge, skill or ability to be assessed)

6b) Students will demonstrate fundamental skills in artificial intelligence, machine learning, and design intentional user experiences.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

SLO 6b will be assessed using exam/quiz questions administered as part of the ITCS 3153 Introduction to Artificial Intelligence course. This course is a required for the Artificial Intelligence, Robotics and Gaming undergraduate concentration. The questions in the attached SLO6b-BS_questionbank document will be evaluated annually to insure they assess current concepts as are taught in the required courses of the concentration. These questions will directly assess the students’ recognition of approaches to and components of artificial intelligence.

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The assessment will be performed by the instructor every spring semester using a total of fifteen questions from the SLO-6b AI-Robotics-Gaming_question bank given during 1 or more exams/quizzes administered to students in the ITCS 3153 course during the semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee’s comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

80% of the students assessed will correctly answer 10 or more of the 15 SLO 6b assessment questions.

Student Learning Outcome 6c: Data Science (knowledge, skill or ability to be assessed)

6c) Students will demonstrate knowledge of data mining, database design, deep analytics.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

A substantial database project in **ITCS 3160 Database Design and Implementation** requires the student to demonstrate the ability to design and implement a database solution to explore an analytical question. The students are assessed on their thorough understanding of use of appropriate data structures and algorithms; apply analytic and data mining techniques to a large data set; and make meaningful interpretation. The project report will be evaluated.

SLO6c-BS Rubric Data Science Project

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

A data science project will be graded by the ITCS 3160 instructor using a scoring rubric [*SLO6c-BS Rubric Data Science Project*] for knowledge of data analytic and mining techniques applied to a large data set, with a scale of 1-5. The assessment will be performed by the ITCS 3160 instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee’s comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.

Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

80% of the students assessed will score at or above “Accomplished” on each of the project skill areas.

Student Learning Outcome 6d: Software Systems and Networks (knowledge, skill or ability to be assessed)

6d) Students will possess programming skills in parallel and distributed computing.

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Aggregated scores on all programming assignments in the spring ITCS 3145 course will be collected to demonstrate ability in parallel programming techniques. The students are assessed on their thorough understanding of use of parallel programming by a programming assignment. *SLO6d-BS_Rubric_SSN*

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The programming assignments (currently there are 7 in a course section) will be graded by the ITCS 3145 instructor using a scoring rubric [*SLO6d-BS_Rubric_SSN*] for knowledge of parallel programming, with a scale of 1-5. The assessment will be performed by the ITCS 3145 instructor every Spring semester. Each instructor will fill out an internal CS SLO Assessment Form reporting the performance statistics of the students and submit it to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets where targets were missed. The Committee’s comments will be incorporated by the Assistant Chair into the final report. The final report is sent to the Department Chair for review and then submitted to the College Assessment Lead. Where performance targets were missed, the Assistant Chair will communicate suggested changes and recommendations to each affected instructor.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

80% of the students assessed will achieve an average score of 3.0 or better on the rubric elements (based on a 5 point scale) on the programming skills assessed on the programming assignments in ITCS 3145.

Student Learning Outcome 6e: Cyber Security (knowledge, skill or ability to be assessed)

6e) Students will be able to **identify the most common attacks to security protocols and procedures associated with software systems.**

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

Students in **ITIS 3200 Information Security and Privacy** will be scored on how well they understand and can devise countermeasure(s) for the following common attacks: man-in-the-middle, forward search, and brute force. Exams will include questions similar to the examples provided in the SLO 6e-BS_Cyber Security_Test Items.docx and graded on a rubric [SLO 6e-BS Cyber Security_Rubric].

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

ITIS 3200 instructors will grade student responses according to a rubric that scores student performance across the multiple skill areas described above in the Effectiveness Measure during the spring semester. After collecting data, the instructors will report results, comments and suggestions for improvements to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets by submitting a report to the Department Chair, the Assistant Chair, and the College's Associate Dean for Administration, copying each affected instructor. The Assistant Chair will coordinate with instructors to ensure that deficient areas are corrected and suggested changes are implemented. The Assistant Chair will be responsible for generating the Final Assessment Report and gaining approval for the Report from the Department Chair and the College's Associate Dean for Administration.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of "acceptable" or higher on the Oral Presentation Scoring Rubric.

At least 80% of students will score at or above “Accomplished” on each of the project skill areas.

Student Learning Outcome 6f: Software Engineering (knowledge, skill or ability to be assessed)

6f) Students will demonstrate the ability to [document the requirements for a software project in narrative and graphical form.](#)

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

In **ITIS 3300 Software Requirements and Project Management**, student teams will create a Software Requirements Specification (SRS) and include documentation of use cases and graphical system models. The SRS will be judged in the areas of document organization, clarity of expression, presence of required elements, extent to which the requirements are independent of their implementation, and the presence and accuracy of supporting graphical models and use cases. SRS project guidelines are provided to the students then the student project proposals are reviewed and approved by the instructor before the students begin work.

SLO6f-BS_SoftwareRequirements_Instructions

SLO6f-BS_SoftwareRequirements_Rubric

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

The SRS will be graded by the course instructor each spring semester that ITIS 3300 is taught. A rubric will be used to score student group performance on a scale of 1 to 5 across the multiple skill areas described above in the Effectiveness Measure. After collecting data, the instructors will report results, comments and suggestions for improvements to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets by submitting a report to the Department Chair, the Assistant Chair, and the College’s Associate Dean for Administration, copying each affected instructor. The Assistant Chair will coordinate with instructors to ensure that deficient areas are corrected and suggested changes are implemented. The Assistant Chair will be responsible for generating the Final Assessment Report and gaining approval for the Report from the Department Chair and the College’s Associate Dean for Administration.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

At least 80% of students will score at or above “Adequate” (i.e., a 3 on the scoring rubric) on each of the project skill areas.

Student Learning Outcome 6g: Web and Mobile Apps (knowledge, skill or ability to be assessed)

6g) Students will demonstrate [the ability to create static Web pages using HTML and JavaScript](#).

Effectiveness Measure: Identify the data collection instrument, e.g., exam, project, paper, etc. that will be used to gauge acquisition of this student learning outcome and explain how it assesses the desired knowledge, skill or ability. A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.

ITIS 2300 Web-Based Application Development students will create and post a series of four to six Web pages using a common theme. The set of Web pages will be judged as a whole by evaluating the following criteria: understanding of the target demographic, effective use of HTML tags and JavaScript elements, wide browser compatibility, and aesthetics. Project guidelines are provided to the students.

SLO6g-BS_Instructions_WebDevelopmentProject

SLO6g-BS_Rubric_WebDevelopmentProject

Methodology: Describe when, where and how the assessment of this student learning outcome will be administered and evaluated. Describe the process the department will use to collect, analyze and disseminate the assessment data to program faculty and to decide the changes/improvements to make on the basis of the assessment data.

Students will be evaluated on their ability to use a specified set of HTML components and JavaScript commands in the spring semester. A rubric will be used to score individual student performance across the multiple skill areas described above in the Effectiveness Measure. After collecting data, the instructors will report results, comments and suggestions for improvements to the Assistant Chair. The Assistant Chair will provide additional analysis and comments as needed and will forward all results and suggestions to the Departmental Undergraduate Committee for discussion and analysis. The Committee will evaluate results, identify areas for improvement, and suggest changes to achieve minimum performance targets by submitting a report to the Department Chair, the Assistant Chair, and the College’s Associate Dean for Administration, copying each affected instructor. The Assistant Chair will coordinate with instructors to ensure that deficient areas are corrected and suggested changes are implemented. The Assistant Chair will be responsible for generating the Final Assessment Report and gaining approval for the Report from the Department Chair and the College’s Associate Dean for Administration.

Performance Outcome: Identify the percentage of students assessed that should be able to demonstrate proficiency in this student learning outcome and the level of proficiency expected.
Example: 80% of the students assessed will achieve a score of “acceptable” or higher on the Oral Presentation Scoring Rubric.

At least 80% of students will score at or above “Developing” (a 3 or above on 5 point scale) on each of the project skill areas.

ITSC 1212 - Introduction to Computer Science I

Description

Introduction to problem-solving using Java including basic computer concepts; source & object code; elements of a programming language; numbering systems; assignment, arithmetic, logical, and relational operations; data types; expressions; variables, constants, and literals; naming conventions; reserved words; program flow; arrays; file I/O; object-oriented concepts (classes, objects, and methods); and problem-solving techniques. Four (4) credit hours.

Prerequisite: None.

Co-requisite: ITSC 1212L. The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade.

Lab Facilities

Woodward 120 is an open lab available to all students enrolled in a course offered by the College. All software required for this course is available in that lab.

Topics

- Basic computer concepts (CPU, ALU, memory, peripherals, etc.)
- Source & object code, IDE
- Elements of a programming language
- Numbering systems (decimal, binary, octal, hexadecimal, conversions, basic arithmetic operations)
- Assignment, arithmetic, logical, and relational operations; order of operations
- Data types
- Expressions, evaluation of expressions, variable substitution in expressions, mixed data types
- Variables, constants, and literals; naming conventions; reserved words
- Program flow (sequence, selection, and iteration)
- Arrays (1- and 2-dimensional; indexes, initializing, processing using loops)
- File I/O, formatting output
- Object-oriented elements (classes, objects, fields, methods)
- Problem-solving techniques (problem decomposition, step-wise refinement, modularity)

ITSC 1213 - Introduction to Computer Science II

Description

Advanced topics in Java including version control, use of debuggers, class design, aggregation and association, exception handling, generic and abstract types, inheritance, polymorphism, interfaces, and abstract classes. See **ITSC 1213 Topics** below for a complete list. Four (4) credit hours.

Prerequisite: ITSC 1212 with a grade of 'C' or higher. This course will not repeat ITSC 1212 topics; you are required to already be familiar with the entire content of ITSC 1212.

Co-requisite: ITSC 1213L. The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade.

Required Materials

Text: TBD

Clicker: Turning Technology Clicker

Other materials at the instructor's discretion

Lab Facilities

Woodward 120 is an open lab available to all students enrolled in a course offered by the College. All software required for this course is available in that lab.

Topics

- Java implementation (JDK, javac, Java VM, Java API, JavaDoc)
- IDE (using a debugger, basic version control)
- Class design (UML, aggregation & association)
- Advanced Java Elements (importing, protected and package specifiers, overloading vs overriding, exception handling, copy constructors, static methods, returning an object reference from a method)
- Advanced Java Types (enumerated types, generic types)
- Advanced Java Concepts (inheritance, polymorphism, interfaces, packages)
- Advanced Java Classes (String, StringTokenizer, abstract classes, Graphics2D)
- Array operations (ArrayLists, Multiple arrays within for loops)
- I/O (Simple file I/O, Scanner class)
- GUIs
- Threads
- Introduction to secure programming

ITSC 1600 - Computing Professionals

Description

This course serves as an introduction on how to become a professional in computing fields. Students will learn about setting goals, defining their dream career, becoming a part of the university, planning coursework, building network, managing time, and working in a team. Additionally, several guest speakers and industry panels will discuss and explain in details various aspects of a professional career in IT related fields. Throughout this course, students will build a professional profile including their goals, values, dream career, student organizations, coding skills, communication skills, curriculum plan, professional network, a team TED talk, resume, and a 30-second elevator pitch.

Prerequisite: None.

Objectives

- To learn self-discovery, career inquiry and team awareness
- To build a foundation for a career in I.T. fields
- To enhance various skills of a computing professional.

Textbook

The optional text for the course is Building Your I.T. Career, Second Edition by Matthew Moran. This is available from Amazon. If you buy elsewhere, be sure to get the correct edition.

Topics

- Defining Goals
- Managing Your Time
- Learning about Careers in Computing
- Shadowing a Professional
- Communicating like a Professional
- Utilizing University Resources
- Planning Your Courses
- Understanding Diversity in Computing
- Working in a Team
- Creating Your Resume
- Learning Technical Skills
- Searching for Internship Opportunity
- Presenting a Project
- Putting Your Profile Together
- Interviewing For a Position

ITSC 2175 - Logic and Algorithms

Description

This course will provide a study of discrete mathematical concepts. It will introduce propositional calculus, predicate calculus, algorithms, logic functions, finite-state machines; logic design. (3 credit hours)

Prerequisite: *ITSC 1212 and ITSC 1212L and (MATH 1120 or MATH 1241)*

Textbook

Discrete Mathematics and Its Applications by Kenneth H. Rosen

Learning Objectives

- An understanding of the discrete mathematical concepts
- Experience applying formal methods, proof techniques and probability statistics
- Ability to apply concepts acquired to real-world applications

Topics

- Basic Logic and Proofs
- Basic Structures: Sets, Relations and Functions
- Order of Complexity.
- Proof Techniques. *Induction and recursion.*
- Counting. *Pigeonhole principle, permutations, combinations.*
- Discrete Probability. *Probability theory, bayes' theorem, expected values and variance*
- Basic Automata. *Intro to finite state machines and, Turing machines*

ITSC 2214 - Data Structures and Algorithms

Description

This course will provide a study of the theory and implementation of abstract data types (ADTs) including stacks, queues, specialized trees and graphs. It will include the implementation and analysis of algorithms related to the various data structures studied including creation, searching, and traversal of ADTs. (3 credit hours)

Prerequisite: ITSC 1213 and ITSC 1213L with grade C or better

Textbook

Algorithms in C++/Java Part1-4 and Part 5 by Robert Sedgewick

Learning Objectives

- An understanding of the theory of abstract data types
- Able to determine the most suitable algorithm for a given problem
- Experience efficiently implementing algorithms

Topics

- Principles of Algorithm Analysis. *Order of complexity, big-O notations, time-space trade-off's*
- Elementary Data Structures. *Arrays, linked list, strings, compound data structures*
- Abstract Data Types. *Abstract objects and collections of objects, ADT of sets, maps, stacks, queues.*
- Algorithm Strategies. *Greedy, divide-and-conquer, recursive backtracking, dynamic programming, heuristics, P and NP completeness (brief introduction);*
- Recursion and Trees. *Trees , traversal*
- Sorting. *Selection, insertion, bubble, quick, merge*
- Priority queues and heapsort
- Searching. *Sequential, binary search tree (insertion, deletion and balancing), hashing.*
- Graphs. *Representation (adjacency matrix, adjacency list), graph search (depth-first, breadth-first), minimum spanning trees, shortest paths.*

ITSC 3146 - Introduction to Operating Systems and Networking

Description

Introduces the fundamentals of operating systems together with the basics of networking and communications. Topics include: processes, threads, scheduling, cache, memory management, file systems, interprocess communication, network architecture and protocols, HTTP, MAC, IP, TCP/UDP, internet routing. (Fall, Spring). (3 credit hours)

Prerequisites: ITSC 1213 and ITSC 1213L

Learning Outcomes

Upon successful completion of this course, students should have:

- Ability to use operating system interfaces: interrupts and system calls.
- Ability to program run-time environments: processes, threads, synchronization primitives.
- Ability to implement elementary networking (TCP, IP, client / server) and use inter-process communication
- Ability to implement a simple client-server socket-based application
- Ability to contrast Kernel and user mode in an operating system
- Understand the potential threats to an operating system

Suggested Textbook

- *Modern Operating Systems*, Fourth Edition. (Prentice Hall, 2014. ISBN 978-0133591620) by Andrew S. Tanenbaum, 2014
- *Operating System Concepts*, Seventh Edition (ISBN 978-0471694663) By Abraham Silberschatz, Peter B. Galvin and Greg Gagne, 2004
- *Operating Systems: Principles and Practice*, 2nd Edition (ISBN 978-0985673529) By Thomas Anderson and Michael Dahlin, 2014
- *Computer Networking: A Top-Down Approach*, Sixth Edition. (Addison Wesley, 2012. ISBN 978-0132856201) by Jim Kurose and Keith Ross, 2012

Topics

- Operating Systems (6 weeks)
- Networks (4 weeks)
- System Administration (4 weeks)

ITSC 3155 - Software Engineering

Description

This course provides an introduction to software engineering, which advances the study and application of engineering principles, methods, and techniques that can help us to improve the process of creating software as well as the resulting software products. The course covers fundamentals of software engineering, including: modern software process models; eliciting, specifying, and evaluating software system requirements; designing software systems to embody required quality attributes, including usability and security; an introduction to reusable software design solutions in the form of software architectural styles and design patterns; software system modeling, implementation, and deployment; and software quality assurance (measurement, inspection, testing). Project planning, working in teams, and using modern software development tools will also be explored.

Prerequisites: ITSC 2214

Textbook

George Fairbanks, Just Enough Software Architecture: A Risk-Driven Approach. Marshall and Brainerd, first edition, 2010.

Topics

- Software Process Models
- Requirements Engineering
- Project Planning and Teamwork
- Software Design
- Test-Driven Development
- Working on Large-Scale Systems – in Teams
- Quality Assurance

Team Course Project

A substantial software engineering project, in which students work as a part of team to create a new software system or evolve an existing software system, is a required component of this course.

ITSC 3181+L - Introduction to Computer Architecture

Description

Introduces the fundamentals of computer architectures and their programmability using assembly and system programming. Topics include: logic design, processor architecture, memory hierarchies, assembly programming, C programming, process and thread parallelism. (Fall, Spring). (3+1 credits)

Prerequisites: ITSC 1213 and ITSC 1213L and ITSC 2175 with grade of C or better

Co-requisite: ITSC 3181L. The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade.

Suggested Textbook

- Computer Organization and Design, Fourth Edition: The Hardware/Software Interface (The Morgan Kaufmann Series in Computer Architecture and Design) 4th Edition by David A. Patterson (Author), John L. Hennessy (Author). ISBN-13: 978-0123747501
- Structured Computer Organization (5th Edition) 5th Edition by Andrew S. Tanenbaum. ISBN-13: 978-0131485211

Learning Outcomes

Upon successful completion of this course, students should:

- Understand how digital logic composes all computing platforms
- Understand pipelined processor architecture
- Understand memory hierarchies
- Be able to read and program assembly code and how it maps in the architecture
- Be able to program in C and how it maps to assembly
- Be able to implement a simple parallel applications that uses processes and threads

Topics

- Assembly (4 weeks)
- Architecture (4 weeks)
- System/Parallel Programming (6 weeks)

Laboratory Topics

- Architecture
- Assembly
- System

ITCS 3120 – Introduction to Interactive Computer Graphics

Description

This course will introduce graphics hardware; raster algorithms; event based programming; shader programming; anti-aliasing methods; matrix algebra for change of coordinates and 2D geometric transformations; 2D viewing transformation and clipping; 2D curves and 2D splines. (3 credit hours)

Prerequisites: ITSC 2214 and MATH 2164

Topics

- Introduction
- Event Based Programming for Graphical Applications
- Shader Programming
- Pixel Operations
- Rasterizing Linear Primitives
- Points, Vectors, Coordinate Systems
- Rasterizing Filled Primitives
- Aliasing and Anti-Aliasing
- Matrices for Change of Coordinates
- Matrices for 2D Transforms
- 2D Viewing
- Transformation Hierarchies
- 2D Curves and Splines

Learning Objectives

This course familiarizes students with fundamental 2D computer graphic algorithms and mathematics and techniques for interactive graphical programming.

Textbook:

Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL, 6th Edition. Edward Angel and Dave Shreiner.

ITCS-3145 – Parallel and Distributed Computing

Description

Parallel and distributed computing is the use of multiple processors or computers to achieve greater performance. All computers today have multiple processor cores. Topics include classification of parallel systems, programming parallel shared-memory systems, programming distributed-memory systems, patterns for parallel programming, foundation of parallel algorithms, languages and tools for parallel programming. (3 credit hours)

Prerequisite: ITSC 2214 and ITSC 3181

Topics

Potential for speed-up using multiple processors, speed-up factor, Amdahl's law
 Parallel computers: architectural types, shared memory, distributed memory, GPU systems.
 Programming with shared memory programming, threads, OpenMP
 Shared memory programming issues, accessing shared data, critical sections, locks, condition variables, serializing code, deadlock, semaphores, monitors
 Dependency analysis (Bernstein's conditions), data shared in caches, false sharing, sequential consistency, code re-ordering.
 Message passing programming, MPI
 Parallel algorithms (e.g. for sorting, searching, matrix multiplication, etc.)
 Parallel design patterns
 Hybrid programming to take advantage of clusters that have both distributed-memory and shared memory
 CPU-GPU systems, programming in CUDA, issues for achieving high performance.

Textbook

Parallel Programming: Techniques and Application Using Networked Workstations and Parallel Computers, 2nd edition, B. Wilkinson and M. Allen, Prentice Hall Inc., 2005, ISBN 0-13-140563-2. Recommended but not required.

Learning Objectives

Upon successful completion of this course, the student shall be:

- able to program a shared memory parallel system using OpenMP
- able to program a distributed memory parallel system using MPI
- able to program GPU parallel system using CUDA
- able to recognize issues in parallelizing code
- familiar with common parallel algorithms for various applications

ITCS 3190 - Cloud Computing for Data Analysis

Description

Introduction to the principles of cloud computing for data science applications. This course focuses on distributed computing, and algorithms for scalable data processing. Topics include: parallel processing, information retrieval, knowledge discovery in databases, web search, computational advertising, and scientific data analysis. Students are expected to bring their laptops to class. (3 credit hours)

Prerequisite: ITSC 2214 Data Structures and Algorithms

Topics

- Data Storage and Analysis Beyond Batch
- Distributed Computing
- Algorithms for Scalable Data Processing
- Hadoop Streaming
- MapReduce Paradigm on Clusters
- Anatomy of YARN application run
- Distributed File System
- File-based Data Structures
- Developing of MapReduce Application and running on cluster
- Index Construction and Compression
- Scoring, Term Wighting and Vector Space Model
- Probabilistic Information Retrieval
- Vector Space Classification
- Flat and Hierarchical Clustering
- Web Search Basics

Learning Objectives

Upon completion of this course, the student shall be able to:

- Identity the major distributed computing technologies and apply them for data analysis
- Build application programs for scalable data processing using parallel computing
- Create and modify knowledge discovery in databases algorithms such as pattern classification, decision trees, unsupervised learning, and web mining.

Textbook

Hadoop: The Definitive Guide, 4th Edition, by Tom White, O'Reilly, 2015
ISBN: 978-1-4919-0163-2

ITCS 4124 – Advanced 3D Computer Graphics

Description

This course will introduce 3D transforms, 3D viewing and visibility algorithms; local illumination models; texture mapping; 3D surfaces; advanced lighting models; geometric modeling techniques and procedural geometry methods. (3 credit hours)

Prerequisites: ITCS 3120

Topics

- 3D Transforms
- 3D Viewing
- Visibility Algorithms
- Local Illumination Model
- Texture Mapping
- 3D Surfaces
- Advanced Rendering
- Modeling and Hierarchy
- Procedural Methods

Learning Objectives

This course familiarizes students with fundamental 3D computer graphic algorithms and introduces them to advanced 3D computer graphics rendering and geometry modeling algorithms and techniques.

Textbook

Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL, 6th Edition. Edward Angel and Dave Shreiner.

ITCS 4150 – Mobile Robotics

Description

This course will introduce basic concepts and techniques used in mobile robotics. It will cover topics including mobile robot hardware, sensors and sensor data processing, planning and control, robot architectures, localization and mapping, path planning, and mobile robot applications. (3 credit hours)

Prerequisites: ITSC 2214 and MATH 2164

Topics

- Overview of mobile robotics
- Mobile robot hardware
- Visual and non-visual sensors
- Mobile robot kinematics
- Representing space
- Reasoning and control
- Mobile robot architectures
- Robot localization
- Map building
- Path Planning
- Mobile robot applications

Learning Objectives

- The course will familiarize students with mobile robot concepts and technologies.
- Upon completion of this course, students will be familiar with components of modern mobile robots and be able to design and implement algorithms to control mobile robots.

Textbook

Computational Principles of Mobile Robotics, 2nd Edition, G. Dudek and M. Jenkin, Cambridge University Press, 2010.

ITCS 4182 - Introduction to High-Performance Computing

Description

Fundamentals of parallel computer systems; throughput computing; memory hierarchies; computation/communication overlapping; mapping high level programs to low level components; leveraging accelerators; performance optimization; performance evaluation. (3 credits)

Prerequisite: ITSC 3181, ITCS 3145, or permission of the department.

Topics

- Introduction to Modern Processors
- Single Instruction, Multiple Data (SIMD)
- Memory hierarchies and cache mapping
- Multicore Processors
- Parallel scalability and refined performance models
- Distributed-memory and parallel programming with multiple-processor instruction
- Efficient MPI programming

Learning Objectives

Upon completion of this course, the student shall be:

- able to understand the concept of parallel computer system
- able to perform simulated high performance computing based on actual multicore/multiprocessor systems
- able to understand multilevel memory hierarchies
- able to program computational and communication overlapping
- able to map high-level program using low-level micro-codes
- familiar with common parallel computer structure and performance optimization and evaluations

Textbook

Introduction to High Performance Computing for Scientists and Engineers, *1st edition*, Georg Hager and Gerhard Wellein, Chapman & Hall/CRC Computational Science, CRC press, Taylor & Francis Group, C Chapman & Hall Book, 2011, ISBN-13: 978-1439811924. Recommended but not required.

ITSC 4238 - Intelligent and Interactive System Studio

Description

This project-oriented course will introduce upper-level undergraduate students to algorithms and systems related to robotic vision, perception, navigation planning and control, mapping, localization, and human-robot interaction. Students will work in small groups to develop and implement algorithms in real mobile robots and using real sensors, which can lead to their senior design projects.

Prerequisites: ITCS 3153

Learning Outcomes

Upon successful completion of this course, students shall be able to:

- Understand the design principles for mobile robots
- Develop robot prototypes using a range of sensors and actuators
- Develop components of executable software as part of a team

Topics

Review of applied topics in robotics
Review of applied topics in computer vision
Component-based design
Team-oriented software engineering
Mobile robot hardware
Robotics Operating System (ROS)
Visual and non-visual sensors

ITCS 4111/5111 - Introduction to Natural Language Processing

Description

The course will present practical methods and techniques of natural language processing and text mining. These techniques, mainly the techniques of syntactic and semantic processing, will be illustrated with specific tasks (such as: Information Extraction, Dialogue Systems, Information Retrieval, etc.). Most programming assignments will for the laptop. Selected ones could be done in the cloud e.g. using AlchemyAPI and/or IBM Bluemix. (Students are expected to bring their laptops to each class). (3 credit hours)

Topics

- Terminology, history, applications, subdomains (morphology, syntax, semantics and pragmatics). Dominant paradigms: symbolic, statistical, neural networks.
- Text preprocessing and basic syntactic processing, tokenization, Zipf's-law, and part of speech tagging.
- Regular expressions and basic information extraction.
- Introduction to syntax, grammars and parsing (1-2 weeks)
- Bayes Theorem and Independence, Naïve Bayes model of classification. Other models of classification (k-NN, rules, etc).
- Vector-space model for text representation, and Boolean information retrieval.
- Stochastic, dependency and unification grammars and parsers.
- Semantics: lexical and compositional, meaning representation, semantic formalisms. (1-2 weeks)
- Discourse representation (1-2 weeks)
- Inference in natural language (1-2 weeks)
- Natural Language Generation (1-2) weeks
- Meaning in distributional semantics: gensim, word2vec, glove (1-2 weeks)
- Dialogue systems (1-2 weeks)
- NLP in the cloud: overview of available tools (would need to be updated yearly)
- AlchemyAPI, metamind.io, IBM Bluemix, Microsoft Azure and others (1-2 weeks)

Learning Objectives

Upon completion of this course, the student shall be able to

- Identity the major natural language technologies and research areas
- Build application programs for text data processing
- Create and modify algorithms for several natural language processing tasks, such as preprocessing, learning grammars, building classifiers, etc.

Textbook

Steven Bird, Ewan Klein, Edward Loper 2009; "Natural Language Processing - Analyzing Text with Python and the Natural Language Toolkit", <http://www.nltk.org/book>. Updated in 2015.

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is a proposal to update the Computer Science curriculum. Library holdings for new courses are described in the attached forms.

LC Subject Heading	Total items held

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal/ ITCS 3145: Parallel and Distributed Computing

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is an updated course described within a proposal to update the Computer Science curriculum. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including UlrichsWeb, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Parallel programming (Computer Science)	189 monographs
Parallel algorithms	76 monographs
Hybrid computers - Congresses	113 monographs
Cluster analysis – Computer programs	5 monographs
Memory management (Computer Science)	1,940 monographs
Distributed shared memory	31 monographs
<i>Journal of Parallel and Distributed Computing</i>	Journal title
<i>Parallel algorithms and applications</i>	Journal title

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal/ ITCS 3190: Cloud Computing for Data Analysis

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is an updated course described within a proposal to update the Computer Science curriculum. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including UlrichsWeb, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Data management	1,161 monographs
File organization (Computer Science)	39 monographs
Electronic data processing – Distributed processing	881 monographs
Cloud computing	198 monographs
<i>Annals of Software Engineering</i>	Journal title
<i>IEEE Cloud Computing</i>	Journal title
<i>MobiSys</i> (Proceedings of... ACM Workshop on Mobile Cloud Computing & Services)	Journal title

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal/ ITCS 4111/5111: Introduction to Natural Language Processing

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is an updated course described within a proposal to update the Computer Science curriculum. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including UlrichsWeb, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Natural language processing (Computer science)	303 monographs
Text processing (Computer science)	141 monographs
Speech processing systems - Congresses	119 monographs
Bayesian statistical decision theory	175 monographs
Automatic speech recognition	105 monographs
<i>Proceedings of the ... IEEE International Conference on Acoustics, Speech and Signal Processing</i>	Journal title
<i>Natural language engineering</i>	Journal title

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal/ ITCS 4150: Mobile Robotics

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is an updated course described within a proposal to update the Computer Science curriculum. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including UlrichsWeb, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Mobile robots	120 monographs
Robot vision	86 monographs
Robots - control systems	204 monographs
Planning – computer simulation	45 monographs
Artificial Intelligence	2,586 monographs
<i>Journal of Intelligent & Robotic Systems</i>	Journal title
<i>IEEE Transactions on Robotics and Automation</i>	Journal title

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date

J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Manuel Perez Quinones

From: Dr. Melanie Sorrell

Date: 12/22/2015

Subject: Updates to the B.A. and B.S. in Computer Science curriculum proposal/ ITCS 4182: Introduction to High-Performance Computing

Summary of Librarian's Evaluation of Holdings:

Evaluator: Dr. Melanie Sorrell

Date: 12/22/2015

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate **x**
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

This is an updated course described within a proposal to update the Computer Science curriculum. Library holdings should be adequate to support student research for this program (see list of items held by subject heading below). Students will have access to relevant databases including UlrichsWeb, Web of Science, Academic Search Premier, ACM Digital Library, IEEE Xplore Digital Library, and the Wiley Online Library.

LC Subject Heading	Total items held
Parallel programming (Computer Science)	189 monographs
Computer engineering	2,508 monographs
High performance computing	343 monographs
Multiprocessors	96 monographs
Memory management (Computer Science)	1,940 monographs
Computer systems - Evaluation	332 monographs
<i>Journal of Parallel and Distributed Computing</i>	Journal title
<i>International Journal of High Performance Computing Applications</i>	Journal title

Melanie Sorrell

Evaluator's Signature

12/22/2015

Date



UNC CHARLOTTE
BELK COLLEGE *of* BUSINESS

Office of Undergraduate Programs

9201 University City Blvd, Charlotte, NC 28223-0001
t/ 704.687.7585 f/ 704.687.1388 belkcollege.uncc.edu

March 3, 2016

Dear Dr. Perez,

Thank you for consulting with the College of Business on the proposed revisions to the B.A. and B.S. in Computer Science.

For the College of Business, the relevant program included in the proposal is the B.A. in Computer Science with a concentration in Financial Services Informatics. Under the proposal, the changes to be made to the current program do not include changes in the number of courses or the composition of courses students are required to take in the College of Business in order to complete the concentration. We do not anticipate increased demand in course offerings or a need to request additional resources due to the proposal.

I am writing to let you know that the College of Business supports the proposal from the College of Computing and Informatics for revisions to the B.A. and B.S. in Computer Science.

Sincerely,

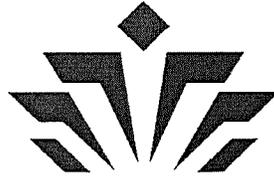
A handwritten signature in black ink, appearing to read 'Pat Mynatt'.

Pat Mynatt, PhD
Associate Dean for Undergraduate Programs
Belk College of Business
9201 University City Blvd.
Charlotte, NC 28223

To: Matt Wyse
From: Kim Harris 
Date: 2/25/16
Re: Long Form Proposal CCI 04-12-2015

I am approving the long-form proposal from Computer Science that updates their B.A. and B.S. programs. I agree with Leslie's suggestion about changing the wording in the "Related Area" sections of the program descriptions.

The proposers did not include the new catalog copy for the revised and new courses that are addressed in the proposal. Those changes are summarized in section 2 of the Justification, however they need to send you the required catalog copy before this all gets updated. Make sure they include the prefix change for ***ITCS 1600 Computing Professionals***. They did not include this course in the list of courses that should have new prefixes.



UNC CHARLOTTE

Office of Academic Affairs

9201 University City Boulevard, Charlotte, NC 28223-0001
t/ 704.687.5717 www.uncc.edu

Date: 2/25/2016
From: Leslie R. Zenk, Assistant Provost
To: Kim Harris, Chair, Undergraduate Course and Curriculum Committee
RE: Long Form CCI 04-12-2015

Following review of the Long Form CCI 04-12-2015 I suggest the following changes to improve the auditability of the majors and the usability of the degree audit:

For the following programs:

Computer Science, Human-Computer Interaction Concentration, B.A.
Computer Science, Information Technology Concentration, B.A.
Computer Science, AI, Robotics & Gaming Concentration, B.S.
Computer Science, Bioinformatics Concentration, B.S.
Computer Science, Cyber Security Concentration, B.S.
Computer Science, Data Science Concentration, B.S.
Computer Science, Software Engineering Concentration, B.S.
Computer Science, Software, Systems & Networks Concentration, B.S.
Computer Science, Web & Mobile Applications Concentration, B.S.

The following change is recommended:

Related Area (15 Credit hours)

May be satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.

Department of Computer Science

<http://cs.uncc.edu>

Computer Science is the cornerstone of modern information technology. It has revolutionized how we learn, communicate, entertain, conduct business, perform research, and practice medicine. This information revolution is just beginning and is providing computer scientists with nearly limitless opportunities to make satisfying and enriching contributions to society. We can think of the work of computer scientists as falling into three categories:

1.) They design and implement software. Computer scientists take on challenging programming jobs. They also supervise other programmers, keeping them aware of new approaches.
2.) They devise new ways to use computers. Progress in the CS areas of networking, database, and human-computer-interface enabled the development of the World Wide Web. Now, researchers are working to make robots to be practical aides that demonstrate intelligence, are using databases to create new knowledge, and are using computers to help decipher the secrets of our DNA.
3.) They develop effective ways to solve computing problems. For example, computer scientists develop the best possible ways to store information in databases, send data over networks, and display complex images. Their theoretical background allows them to determine the best performance possible, and their study of algorithms helps them develop new approaches that provide better performance. Computer science spans the range from theory to programming. While other disciplines can produce graduates better prepared for specific jobs, computer science offers a comprehensive foundation that permits graduates to adapt to new technologies and new ideas.

The Department of Computer Science offers a wide variety of programs to match the diverse requirements of employers. The computer science major may pursue a program leading to one of four degrees: Bachelor of Arts, Bachelor of Science, or Master of Science in Computer Science; or Ph.D. in Computing and Information Systems. (See the *UNC Charlotte Graduate Catalog* for information on the M.S. and Ph.D. degrees.) Students are prepared for their profession through a comprehensive program of courses and research opportunities in departmental state-of-the-art computing labs.

Grade Requirements

The GPA requirement for all Computer Science undergraduate degree programs is 2.0 or above in each of the following three categories: (1) all courses applied to the degree, (2) all courses in the major, and (3) all upper-division courses in the major.

~~Bachelor of Science in Computer Science with Concentration in Computing Systems~~

~~The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.~~

~~Degree Requirements~~

~~The B.S. in Computer Science requires 120 credit hours of coursework.~~

~~Major Courses (58 credit hours)~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

~~ITCS 1213L Programming Lab II (0)~~
~~ITCS 1600 Computing Professionals (1)~~
~~ITCS 2175 Logic and Algorithms (3)~~
~~ITCS 2214 Data Structures (3)~~
~~ITCS 2215 Design and Analysis of Algorithms (3)~~
~~ITCS 3146 Operating Systems and Networking (3)~~
~~ITCS 3155 Software Engineering (3)~~
~~ITCS 3160 Database Design and Implementation (3)~~
~~ITCS 3181 Logic and Computer Systems (3)~~
~~ITCS 3181L Computer Systems Lab and Recitation (1)~~
~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~
~~ITCS 4102 Programming Languages (3)~~
~~ENGL 2116 Introduction to Technical Communication (3) (W)~~
~~ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~
~~MATH 1241 Calculus I (3)~~
~~MATH 1242 Calculus II (3)~~
~~MATH 2164 Matrices and Linear Algebra (3)~~
~~PHIL 1106 Critical Thinking (3)~~
~~STAT 2122 Introduction to Probability and Statistics (3)~~

Concentration Courses (12 credit hours)

Select four of the following:

~~ITCS 3110 Compiler Construction (3)~~
~~ITCS 3112 Design and Implementation of Object Oriented Systems (3)~~
~~ITCS 3143 Operating Systems (3)~~
~~ITCS 3166 Introduction to Computer Networks (3)~~
~~ITCS 4145 Parallel Computing (3)~~
~~ITCS 4181 Microcomputer Interfacing (3)~~

Capstone Experience (3 credit hours)

Select one of the following:

~~ITCS 4155 Software Development Projects (3)~~
~~ITCS 4232 Game Design and Development Studio (3)~~
~~ITCS 4650 Senior Project I (3)~~
~~ITCS 4651 Senior Project II (3)~~
~~ITCS 4990 Undergraduate Research (3)~~
~~ITCS 4991 Undergraduate Thesis (3)~~

Outside Concentration (15 credit hours)

~~A component of 15 credit hours of approved non computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non ITCS courses, forming an integrated program of secondary strength.~~

Business Outside Concentration

~~Consists of a prescribed set of courses from the College of Business and one 3000 level course from a restricted set of choices.~~

Mathematics Outside Concentration

~~Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.~~

Technical Electives (6 credit hours)

~~Students select two additional ITCS or ITIS courses at the 3000 level or above.~~

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Bachelor of Science in Computer Science with Concentration in Game Design and Development

The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.

Degree Requirements

The B.S. in Computer Science requires 120 credit hours of coursework.

Major Courses (58 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3181 Logic and Computer Systems (3)
ITCS 3181L Computer Systems Lab and Recitation (1)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ITCS 4102 Programming Languages (3)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
PHIL 1106 Critical Thinking (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 4120 Introduction to Computer Graphics (3)
ITCS 4230 Introduction to Game Design and Development (3)
ITCS 4231 Advanced Game Design and Development (3)
ITCS 4235 Game Engine Construction (3)
ITCS 4236 Artificial Intelligence for Computer Games (3)
ITCS 4237 Audio Processing for Entertainment Computing (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Outside Concentration (15 credit hours)

A component of 15 credit hours of approved non-computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non-ITCS courses, forming an integrated program of secondary strength.

Business Outside Concentration

Consists of a prescribed set of courses from the College of Business and one 3000-level course from a restricted set of choices.

Mathematics Outside Concentration

Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.

Technical Electives (6 credit hours)

Students select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Bachelor of Science in Computer Science with Concentration in Graphics and Visualization

The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.

Degree Requirements

The B.S. in Computer Science requires 120 credit hours of coursework.

Major Courses (58 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3181 Logic and Computer Systems (3)
ITCS 3181L Computer Systems Lab and Recitation (1)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ITCS 4102 Programming Languages (3)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
PHIL 1106 Critical Thinking (3)

~~STAT 2122 Introduction to Probability and Statistics (3)~~

~~Concentration Courses (12 credit hours)~~

~~Select four of the following:~~

~~ITCS 3134 Digital Image Processing (3)~~

~~ITCS 4120 Introduction to Computer Graphics (3)~~

~~ITCS 4121 Information Visualization (3)~~

~~ITCS 4122 Visual Analytics (3)~~

~~ITCS 4123 Visualization and Visual Communication (3)~~

~~Capstone Experience (3 credit hours)~~

~~Select one of the following:~~

~~ITCS 4155 Software Development Projects (3)~~

~~ITCS 4232 Game Design and Development Studio (3)~~

~~ITCS 4650 Senior Project I (3)~~

~~ITCS 4651 Senior Project II (3)~~

~~ITCS 4990 Undergraduate Research (3)~~

~~ITCS 4991 Undergraduate Thesis (3)~~

~~Outside Concentration (15 credit hours)~~

~~A component of 15 credit hours of approved non-computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non-ITCS courses, forming an integrated program of secondary strength.~~

~~Business Outside Concentration~~

~~Consists of a prescribed set of courses from the College of Business and one 3000-level course from a restricted set of choices.~~

~~Mathematics Outside Concentration~~

~~Consists of 9 credit hours of approved mathematics courses at the 3000-level or above plus 6 additional credit hours of elective courses.~~

~~Technical Electives (6 credit hours)~~

~~Students select two additional ITCS or ITIS courses at the 3000-level or above.~~

~~Suggested Curriculum~~

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

~~Bachelor of Science in Computer Science with Concentration in Intelligent Systems~~

~~The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.~~

~~Degree Requirements~~

~~The B.S. in Computer Science requires 120 credit hours of coursework.~~

~~Major Courses (58 credit hours)~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3181 Logic and Computer Systems (3)
ITCS 3181L Computer Systems Lab and Recitation (1)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ITCS 4102 Programming Languages (3)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
PHIL 1106 Critical Thinking (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 3134 Digital Image Processing (3)
ITCS 3152 Symbolic Programming (3)
ITCS 3153 Introduction to Artificial Intelligence (3)
ITCS 4151 Intelligent Robotics (3)
ITCS 4152 Computer Vision (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Outside Concentration (15 credit hours)

A component of 15 credit hours of approved non-computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non-ITCS courses, forming an integrated program of secondary strength.

Business Outside Concentration

Consists of a prescribed set of courses from the College of Business and one 3000-level course from a restricted set of choices.

Mathematics Outside Concentration

Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.

Technical Electives (6 credit hours)

Students select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study

available online at academics.uncc.edu.

Bachelor of Science in Computer Science Networking and Distributed Systems

The Bachelor of Science program offers a broad core of computing subjects and allows the student to select a concentration for an in-depth study in Computing Systems, Game Design and Development, Graphics and Visualization, Intelligent Systems, or Networking and Distributed Computing. This program prepares students to continue their education in master's or doctoral programs, or to enter the business world as a computer scientist.

Degree Requirements

The B.S. in Computer Science requires 120 credit hours of coursework.

Major Courses (58 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3181 Logic and Computer Systems (3)
ITCS 3181L Computer Systems Lab and Recitation (1)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ITCS 4102 Programming Languages (3)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
PHIL 1106 Critical Thinking (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 3166 Introduction to Computer Networks (3)
ITCS 4141 Computer Organization and Architecture (3)
ITCS 4145 Parallel Computing (3)
ITCS 4146 Grid Computing (3)
ITIS 3200 Introduction to Information Security and Privacy (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Outside Concentration (15 credit hours)

~~A component of 15 credit hours of approved non computer science courses forming an integrated program of outside concentration must be included. In general, an outside concentration consists of 6 hours at the 3000 level or above, plus an additional 9 hours of approved non ITCS courses, forming an integrated program of secondary strength.~~

~~*Business Outside Concentration*~~

~~Consists of a prescribed set of courses from the College of Business and one 3000 level course from a restricted set of choices.~~

~~*Mathematics Outside Concentration*~~

~~Consists of 9 credit hours of approved mathematics courses at the 3000 level or above plus 6 additional credit hours of elective courses.~~

~~**Technical Electives (6 credit hours)**~~

~~Students select two additional ITCS or ITIS courses at the 3000 level or above.~~

~~**Suggested Curriculum**~~

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

Computer Science, AI, Robotics & Gaming Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education program](#). Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)
- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.

Capstone Course (3 credit hours)

Select one of the following:

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

For this concentration, either of the courses below could also be used to satisfy the Capstone requirement.

- [ITCS 4232 Game Design & Development Studio \(3 credits\)](#)
- [ITCS 4238 Intelligent and Interactive System Studio \(3 credits\)](#)

AI, Robotics, & Gaming Concentration: Courses (21 credit hours)

Required Course (3 credit hours)

- [ITCS 3153 Intro to Artificial Intelligence \(3 credits\)](#)

Concentration Electives (12 credit hours)

Choose FOUR of the following courses:

- [ITCS 3134 - Digital Image Processing \(3 credits\)](#)
- [ITCS 3120 - Introduction to Computer Graphics \(3 credits\)](#)
- [ITCS 4123 - Visualization and Visual Communication \(3 credits\)](#)
- [ITCS 4124 - Advanced 3D Computer Graphics \(3 credits\)](#)
- [ITCS 4150 - Mobile Robotics \(3 credits\)](#)
- [ITCS 4151 - Intelligent Robotics \(3 credits\)](#)
- [ITCS 4152 - Computer Vision \(3 credits\)](#)
- [ITCS 4156 - Machine Learning \(3 credits\)](#)
- [ITCS 4230 - Introduction to Game Design and Development \(3 credits\)](#)
- [ITCS 4231 - Advanced Game Design and Development \(3 credits\)](#)

Technical Electives Courses (6 credit hours)

Select electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.

Free Electives Courses (7 credit hours)

Select courses offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a [suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.](#)

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and

service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the program page.

Computer Science, Data Science Concentration B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- AI, Robotics & Gaming (Department of Computer Science)
- Bioinformatics (Department of Bioinformatics and Genomics)
- Cyber Security (Department of Software and Information Systems)
- Data Science (Department of Computer Science)
- Software Engineering (Department of Software and Information Systems)
- Software, Systems & Networks (Department of Computer Science)
- Web & Mobile Applications (Department of Software and Information Systems)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education program](#). Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)
- ITSC 1600 - Computing Professionals (1 credit)
- ITSC 2175 - Logic and Algorithms (3 credits)
- ITSC 2214 - Data Structures and Algorithms (3 credits)
- ITSC 3146 Operating Systems and Networking (3 credits)
- ITSC 3155 Software Engineering (3 credits)
- ITSC 3181/L Introduction to Computer Architecture (4 credits)

Critical Thinking (3 credit hours)

- PHIL 1106 – Critical Thinking (3 credits)

Additional Required Courses (6 credit hours)

- STAT 2122 - Introduction to Probability and Statistics (3 credits)
- MATH 2164 - Matrices and Linear Algebra (3 credits)

Related Area (15 credit hours)

Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Data Science Concentration (21 credit hours)

Required Courses (6 credit hours)

- ITCS 3160 Database Implementation and Design (3 credits)

- [ITCS 3162 Intro to Data Mining \(3 credits\)](#)

Concentration Electives (9 credit hours)

[Select three courses from the list below, with at least one from each of the two groups.](#)

Group A

- [ITCS 3156 Machine Learning \(3 credits\)](#)
- [ITCS 3216 Intro to Cognitive Science \(3 credits\)](#)
- [ITCS 3190 Cloud computing \(3 credits\)](#)

Group B

- [ITCS 4122 Visual Analytics \(3 credits\)](#)
- [ITCS 3134 Image Processing \(3 credits\)](#)
- [INFO 3236 Business Analytics \(3 credits\)](#)
- [ITIS 4510 Web Mining \(3 credits\)](#)

Technical Electives Courses (6 credit hours)

[Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.](#)

Free Electives Courses (7 credit hours)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at \[academics.uncc.edu\]\(http://academics.uncc.edu\).](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Software, Systems, & Networks Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and

cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education program](#). Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)
- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

[Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 credit hours)

[Select one of the following:](#)

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Software, Systems, & Networks Concentration (21 credit hours)

Required Courses (6 credit hours)

- [ITCS 3145 Parallel and Distributed Computing \(3 credits\)](#)
- [ITCS 3166 Introduction to Computer Networks \(3 credits\)](#)

Concentration Electives (9 credit hours)

[Choose three courses from the following list. The categories are only to indicate sub-areas of this concentration and the courses selected do not need to be within one category.](#)

Systems

- [ITCS 3143 Operating Systems \(3 credits\)](#)
- [ITCS 3160 Database Design and Implementation \(3 credits\)](#)
- [ITCS 4141 Computer Organization and Architecture \(3 credits\)](#)
- [ITCS 4182 - Introduction to High-Performance Computing \(3 credits\)](#)
- [ITIS 4221 Secure Programming and Penetration Testing \(3 credits\)](#)

Software: Programming Languages Foundations and Practice

- [ITCS 3110 Compiler Construction \(3 credits\)](#)
- [ITCS 3112 Design and Implementation of Object-Oriented Systems \(3 credits\)](#)
- [ITCS 4102 Programming Languages \(3 credits\)](#)
- [ITIS 3320 Introduction to Software Testing and Assurance \(3 credits\)](#)

Pervasive, Mobile, and Embedded Computing

- [ITCS 4131 Communication Network Design \(3 credits\)](#)
- [ITCS 4180 Mobile Application Development \(3 credits\)](#)
- [ITIS 4166 Network-Based Application Development \(3 credits\)](#)
- [ITIS 3200 Introduction to Information Security and Privacy \(3 credits\)](#)

Technical Electives Courses (6 credit hours)

[Select three electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.](#)

Free Electives Courses (7 credit hours)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to](#)

[expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

[By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.](#)

Honors Program

[For details about the College of Computing and Informatics Honors Program, visit the program page.](#)

~~Bachelor of Arts in Computer Science with Concentration in Computing Systems~~

~~The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21-24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A. program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.~~

~~Degree Requirements~~

~~The B.A. in Computer Science requires 121 credit hours of coursework.~~

~~Major Courses (39 credit hours)~~

~~ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
PHIL 1106 Critical Thinking (3)~~

~~Mathematics and Statistics Courses (12 credit hours)~~

~~Select one of the following groups of courses:~~

Group 1

~~MATH 1120 Calculus (3)~~

MATH 2164 Matrices and Linear Algebra (3)
STAT 1220 Elements of Statistics I (BUSN) (3)
STAT 2223 Elements of Statistics II (3)

Group 2

MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 3110 Compiler Construction (3)
ITCS 3112 Design and Implementation of Object Oriented Systems (3)
ITCS 3143 Operating Systems (3)
ITCS 3166 Introduction to Computer Networks (3)
ITCS 4145 Parallel Computing (3)
ITCS 4181 Microcomputer Interfacing (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Secondary Concentration (21-24 credit hours)

A component of approved non-computer science courses forming an integrated program of secondary concentration must be included in the B.A. in Computer Science program. In general, a secondary concentration consists of 9 hours at the 3000 level or above, plus an additional 12 hours of approved non-computer science courses, forming an integrated program in a complementary (or applied) area to computer science, possibly forming a minor in that discipline area. A three-hour bridge course is included in the 21-24 hours. This course bridges between computer science and the secondary concentration discipline, which can be a computer science course or a course in the other discipline. The secondary concentration requirement is quite flexible and can be tailored to a student's interest upon the approval of his/her academic advisor. To illustrate this, here are two possibilities:

Business Secondary Concentration

ACCT 2121 Principles of Accounting I (3)
ACCT 2122 Principles of Accounting II (3)
ECON 2101 Principles of Economics—Macro (3)
ECON 2102 Principles of Economics—Micro (3)
INFO 3231 Business Applications Development (3)
INFO 3234 Business Information Systems Analysis and Design (3)
INFO 3236 Business Analytics (3)
or INFO 3240 eBusiness Systems (3)
ITCS 2231 Introduction to Business Programming (3)*

Cognitive Science Secondary Concentration

ITCS 3216 Introduction to Cognitive Science (3)*
ITIS 3130 Human-Computer Interaction (3)
PSYC 3115 Sensation and Perception (3)
PSYC 3116 Human Cognitive Processes (3)

Plus three of the following:

~~ENGL 4161 Modern English Grammar (3)~~
~~ENGL 4167 The Mind and Language (3)~~
~~ENGL 4263 Linguistics and Language Learning (3)~~
~~ITIS 3131 Human and Computer Information Processing (3)~~
~~PSYC 3122 Cognitive and Language Development (3)~~
~~PSYC 3313 Neuropsychology (3)~~
~~PSYC 4316 Cognitive Neuroscience (3)~~

**Bridge course*

Technical Elective Courses (6 credit hours)

Select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Computer Science, Financial Services Informatics Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas.

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The Concentration in Information Technology, offered by the Software and Information Systems Department, emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The Concentration in Human-Computer Interaction, offered by the Software and Information Systems Department, emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics, offered by the Computer Science

Department, is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the General Education program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1120 - Calculus (3 credits)
- STAT 1220 - Elements of Statistics I (3 credits)

Inquiry into the Sciences (10 Credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- ECON 2101 - Principles of Economics Macro (Satisfies Social Science General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 Credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) - Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)

- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (27 credit hours)

Critical Thinking (3 credits)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (3 credits)

- [STAT 2223 - Elements of Statistics II \(3 credits\)](#)

Core Courses (15 credits)

All concentrations in the B.A. in Computer Science include these core courses.

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)

Capstone Courses (6 Credit hours)

- [ITCS 4640 - FSI Industry Foundations Capstone I \(3 credits\)](#)
- [ITCS 4641 - FSI Industry Foundations Capstone II \(3 credits\)](#)

Financial Services Informatics Concentration (51 Credit hours)

- [ITCS 1301 - Introduction to the Financial Services Industry \(3 credits\)](#)
- [ACCT 2121 - Principles of Accounting I \(3 credits\)](#)
- [ECON 2101 - Principles of Economics - Macro \(3 credits\)](#)
- [ITCS 2301 - Financial Services Computing Environment \(3 credits\)](#)
- [ITIS 2300+L - Web-Based Application Development \(plus lab\) \(3 credits\)](#)
- [ACCT 2122 - Principles of Accounting II \(3 credits\)](#)
- [ECON 2102 - Principles of Economics - Micro \(3 credits\)](#)
- [ITIS 3200 - Introduction to Information Security and Privacy \(3 credits\)](#)
- [ITCS 3301 - Intro. to Regulatory Environment for Financial Services Firms \(3 credits\)](#)
- [FINN 3120 - Financial Management \(3 credits\)](#)
- [ITSC 3155 - Software Engineering \(3 credits\)](#)
- [ITIS 3300 - Software Requirements and Project Management \(3 credits\)](#)
- [FINN 3221 - Financial Institutions and Markets \(3 credits\)](#)
- [ITCS 3160 - Data Base Design and Implementation \(3 credits\)](#)

- [ITIS 3130 - Human-Computer Interaction \(3 credits\)](#)
- [FINN 3226 - Financial Theory and Practice \(3 credits\)](#)
- [ITIS 4220 - Vulnerability Assessment and Systems Assurance \(3 credits\)](#)

Free Electives Courses (2 Credit hours)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

[By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.](#)

Honors Program

[For details about the College of Computing and Informatics Honors Program, visit the program page.](#)

Bachelor of Arts in Computer Science with Concentration in Game Design and Development

~~The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21-24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A.~~

program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Degree Requirements

The B.A. in Computer Science requires 121 credit hours of coursework.

Major Courses (39 credit hours)

~~ITCS 1212 Introduction to Computer Science I (4)~~
~~ITCS 1212L Programming Lab I (0)~~
~~ITCS 1213 Introduction to Computer Science II (4)~~
~~ITCS 1213L Programming Lab II (0)~~
~~ITCS 1600 Computing Professionals (1)~~
~~ITCS 2175 Logic and Algorithms (3)~~
~~ITCS 2214 Data Structures (3)~~
~~ITCS 2215 Design and Analysis of Algorithms (3)~~
~~ITCS 3146 Operating Systems and Networking (3)~~
~~ITCS 3155 Software Engineering (3)~~
~~ITCS 3160 Database Design and Implementation (3)~~
~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~
~~ENGL 2116 Introduction to Technical Communication (3) (W)~~
~~ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~
~~PHIL 1106 Critical Thinking (3)~~

Mathematics and Statistics Courses (12 credit hours)

Select one of the following groups of courses:

Group 1

~~MATH 1120 Calculus (3)~~
~~MATH 2164 Matrices and Linear Algebra (3)~~
~~STAT 1220 Elements of Statistics I (BUSN) (3)~~
~~STAT 2223 Elements of Statistics II (3)~~

Group 2

~~MATH 1241 Calculus I (3)~~
~~MATH 1242 Calculus II (3)~~
~~MATH 2164 Matrices and Linear Algebra (3)~~
~~STAT 2122 Introduction to Probability and Statistics (3)~~

Concentration Courses (12 credit hours)

Select four of the following:

~~ITCS 4120 Introduction to Computer Graphics (3)~~
~~ITCS 4230 Introduction to Game Design and Development (3)~~
~~ITCS 4231 Advanced Game Design and Development (3)~~
~~ITCS 4235 Game Engine Construction (3)~~
~~ITCS 4236 Artificial Intelligence for Computer Games (3)~~
~~ITCS 4237 Audio Processing for Entertainment Computing (3)~~

Capstone Experience (3 credit hours)

Select one of the following:

~~ITCS 4155 Software Development Projects (3)~~
~~ITCS 4232 Game Design and Development Studio (3)~~
~~ITCS 4650 Senior Project I (3)~~
~~ITCS 4651 Senior Project II (3)~~
~~ITCS 4990 Undergraduate Research (3)~~

ITCS 4991—Undergraduate Thesis (3)

Secondary Concentration (21–24 credit hours)

A component of approved non-computer science courses forming an integrated program of secondary concentration must be included in the B.A. in Computer Science program. In general, a secondary concentration consists of 9 hours at the 3000 level or above, plus an additional 12 hours of approved non-computer science courses, forming an integrated program in a complementary (or applied) area to computer science, possibly forming a minor in that discipline area. A three-hour bridge course is included in the 21–24 hours. This course bridges between computer science and the secondary concentration discipline, which can be a computer science course or a course in the other discipline. The secondary concentration requirement is quite flexible and can be tailored to a student's interest upon the approval of his/her academic advisor. To illustrate this, here are two possibilities:

Business Secondary Concentration

ACCT 2121—Principles of Accounting I (3)
ACCT 2122—Principles of Accounting II (3)
ECON 2101—Principles of Economics—Macro (3)
ECON 2102—Principles of Economics—Micro (3)
INFO 3231—Business Applications Development (3)
INFO 3234—Business Information Systems Analysis and Design (3)
INFO 3236—Business Analytics (3)
or INFO 3240—eBusiness Systems (3)
ITCS 2231—Introduction to Business Programming (3)*

Cognitive Science Secondary Concentration

ITCS 3216—Introduction to Cognitive Science (3)*
ITIS 3130—Human-Computer Interaction (3)
PSYC 3115—Sensation and Perception (3)
PSYC 3116—Human Cognitive Processes (3)

Plus three of the following:

ENGL 4161—Modern English Grammar (3)
ENGL 4167—The Mind and Language (3)
ENGL 4263—Linguistics and Language Learning (3)
ITIS 3131—Human and Computer Information Processing (3)
PSYC 3122—Cognitive and Language Development (3)
PSYC 3313—Neuropsychology (3)
PSYC 4316—Cognitive Neuroscience (3)

**Bridge course*

Technical Elective Courses (6 credit hours)

Select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Bachelor of Arts in Computer Science with Concentration in Graphics and Visualization

The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21–24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A. program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this

program is less theoretical/mathematical, and more on the applied side of computing.

Degree Requirements

The B.A. in Computer Science requires 121 credit hours of coursework.

Major Courses (39 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ENGL 2116 Introduction to Technical Communication (3) (W)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
PHIL 1106 Critical Thinking (3)

Mathematics and Statistics Courses (12 credit hours)

Select one of the following groups of courses:

Group 1

MATH 1120 Calculus (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 1220 Elements of Statistics I (BUSN) (3)
STAT 2223 Elements of Statistics II (3)

Group 2

MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 3134 Digital Image Processing (3)
ITCS 4120 Introduction to Computer Graphics (3)
ITCS 4121 Information Visualization (3)
ITCS 4122 Visual Analytics (3)
ITCS 4123 Visualization and Visual Communication (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Secondary Concentration (21-24 credit hours)

~~A component of approved non-computer science courses forming an integrated program of secondary concentration must be included in the B.A. in Computer Science program. In general, a secondary concentration consists of 9 hours at the 3000-level or above, plus an additional 12 hours of approved non-computer science courses, forming an integrated program in a complementary (or applied) area to computer science, possibly forming a minor in that discipline area. A three-hour bridge course is included in the 21-24 hours. This course bridges between computer science and the secondary concentration discipline, which can be a computer science course or a course in the other discipline. The secondary concentration requirement is quite flexible and can be tailored to a student's interest upon the approval of his/her academic advisor. To illustrate this, here are two possibilities:~~

~~*Business Secondary Concentration*~~

~~ACCT 2121 Principles of Accounting I (3)
ACCT 2122 Principles of Accounting II (3)
ECON 2101 Principles of Economics—Macro (3)
ECON 2102 Principles of Economics—Micro (3)
INFO 3231 Business Applications Development (3)
INFO 3234 Business Information Systems Analysis and Design (3)
INFO 3236 Business Analytics (3)
 or INFO 3240 eBusiness Systems (3)
ITCS 2231 Introduction to Business Programming (3)*~~

~~*Cognitive Science Secondary Concentration*~~

~~ITCS 3216 Introduction to Cognitive Science (3)*
ITIS 3130 Human-Computer Interaction (3)
PSYC 3115 Sensation and Perception (3)
PSYC 3116 Human Cognitive Processes (3)~~

~~Plus three of the following:~~

~~ENGL 4161 Modern English Grammar (3)
ENGL 4167 The Mind and Language (3)
ENGL 4263 Linguistics and Language Learning (3)
ITIS 3131 Human and Computer Information Processing (3)
PSYC 3122 Cognitive and Language Development (3)
PSYC 3313 Neuropsychology (3)
PSYC 4316 Cognitive Neuroscience (3)~~

~~*Bridge course~~

~~**Technical Elective Courses (6 credit hours)**~~

~~Select two additional ITCS or ITIS courses at the 3000-level or above.~~

~~**Suggested Curriculum**~~

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

~~Bachelor of Arts in Computer Science with Concentration in Intelligent Systems~~

~~The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21-24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A. program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.~~

~~Degree Requirements~~

The B.A. in Computer Science requires 121 credit hours of coursework.

Major Courses (39 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 1600 Computing Professionals (1)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3146 Operating Systems and Networking (3)
ITCS 3155 Software Engineering (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ENGL 2116 Introduction to Technical Communication (3) (W)
FTIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)
PHIL 1106 Critical Thinking (3)

Mathematics and Statistics Courses (12 credit hours)

Select one of the following groups of courses:

Group 1

MATH 1120 Calculus (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 1220 Elements of Statistics I (BUSN) (3)
STAT 2223 Elements of Statistics II (3)

Group 2

MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 2122 Introduction to Probability and Statistics (3)

Concentration Courses (12 credit hours)

Select four of the following:

ITCS 3134 Digital Image Processing (3)
ITCS 3152 Symbolic Programming (3)
ITCS 3153 Introduction to Artificial Intelligence (3)
ITCS 4151 Intelligent Robotics (3)
ITCS 4152 Computer Vision (3)

Capstone Experience (3 credit hours)

Select one of the following:

ITCS 4155 Software Development Projects (3)
ITCS 4232 Game Design and Development Studio (3)
ITCS 4650 Senior Project I (3)
ITCS 4651 Senior Project II (3)
ITCS 4990 Undergraduate Research (3)
ITCS 4991 Undergraduate Thesis (3)

Secondary Concentration (21-24 credit hours)

A component of approved non-computer science courses forming an integrated program of secondary concentration must be included in the B.A. in Computer Science program. In general, a secondary concentration consists of 9 hours at the 3000 level or above, plus an additional 12 hours of approved non-computer science courses, forming an integrated program in a complementary (or applied) area to computer science, possibly forming a minor in that

discipline area. A three-hour bridge course is included in the 21-24 hours. This course bridges between computer science and the secondary concentration discipline, which can be a computer science course or a course in the other discipline. The secondary concentration requirement is quite flexible and can be tailored to a student's interest upon the approval of his/her academic advisor. To illustrate this, here are two possibilities:

Business Secondary Concentration

ACCT 2121 Principles of Accounting I (3)
ACCT 2122 Principles of Accounting II (3)
ECON 2101 Principles of Economics—Macro (3)
ECON 2102 Principles of Economics—Micro (3)
INFO 3231 Business Applications Development (3)
INFO 3234 Business Information Systems Analysis and Design (3)
INFO 3236 Business Analytics (3)
or INFO 3240 eBusiness Systems (3)
ITCS 2231 Introduction to Business Programming (3)*

Cognitive Science Secondary Concentration

ITCS 3216 Introduction to Cognitive Science (3)*
ITIS 3130 Human-Computer Interaction (3)
PSYC 3115 Sensation and Perception (3)
PSYC 3116 Human Cognitive Processes (3)

Plus three of the following:

ENGL 4161 Modern English Grammar (3)
ENGL 4167 The Mind and Language (3)
ENGL 4263 Linguistics and Language Learning (3)
ITIS 3131 Human and Computer Information Processing (3)
PSYC 3122 Cognitive and Language Development (3)
PSYC 3313 Neuropsychology (3)
PSYC 4316 Cognitive Neuroscience (3)

*Bridge course

Technical Elective Courses (6 credit hours)

Select two additional ITCS or ITIS courses at the 3000-level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

~~Bachelor of Arts in Computer Science with Concentration in Networking and Distributed Systems~~

The Bachelor of Arts program requires a more compact set of a computer science core. In addition to a primary computer science concentration as in the B.S. program, it also requires 21-24 credit hours of a second concentration in a non-computer science discipline, possibly forming a minor in that discipline area. Graduates from the B.A. program are expected to have knowledge and skill in computer science plus a complementary discipline, such as business, cognitive science, biology, or any other discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Degree Requirements

The B.A. in Computer Science requires 121 credit hours of coursework.

Major Courses (39 credit hours)

ITCS 1212 Introduction to Computer Science I (4)

~~ITCS 1212L Programming Lab I (0)~~
~~ITCS 1213 Introduction to Computer Science II (4)~~
~~ITCS 1213L Programming Lab II (0)~~
~~ITCS 1600 Computing Professionals (1)~~
~~ITCS 2175 Logic and Algorithms (3)~~
~~ITCS 2214 Data Structures (3)~~
~~ITCS 2215 Design and Analysis of Algorithms (3)~~
~~ITCS 3146 Operating Systems and Networking (3)~~
~~ITCS 3155 Software Engineering (3)~~
~~ITCS 3160 Database Design and Implementation (3)~~
~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~
~~ENGL 2116 Introduction to Technical Communication (3) (W)~~
~~ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~
~~PHIL 1106 Critical Thinking (3)~~

Mathematics and Statistics Courses (12 credit hours)

Select one of the following groups of courses:

Group 1

~~MATH 1120 Calculus (3)~~
~~MATH 2164 Matrices and Linear Algebra (3)~~
~~STAT 1220 Elements of Statistics I (BUSN) (3)~~
~~STAT 2223 Elements of Statistics II (3)~~

Group 2

~~MATH 1241 Calculus I (3)~~
~~MATH 1242 Calculus II (3)~~
~~MATH 2164 Matrices and Linear Algebra (3)~~
~~STAT 2122 Introduction to Probability and Statistics (3)~~

Concentration Courses (12 credit hours)

Select four of the following:

~~ITCS 3166 Introduction to Computer Networks (3)~~
~~ITCS 4141 Computer Organization and Architecture (3)~~
~~ITCS 4145 Parallel Computing (3)~~
~~ITCS 4146 Grid Computing (3)~~
~~ITIS 3200 Introduction to Information Security and Privacy (3)~~

Capstone Experience (3 credit hours)

Select one of the following:

~~ITCS 4155 Software Development Projects (3)~~
~~ITCS 4232 Game Design and Development Studio (3)~~
~~ITCS 4650 Senior Project I (3)~~
~~ITCS 4651 Senior Project II (3)~~
~~ITCS 4990 Undergraduate Research (3)~~
~~ITCS 4991 Undergraduate Thesis (3)~~

Secondary Concentration (21-24 credit hours)

A component of approved non-computer science courses forming an integrated program of secondary concentration must be included in the B.A. in Computer Science program. In general, a secondary concentration consists of 9 hours at the 3000 level or above, plus an additional 12 hours of approved non-computer science courses, forming an integrated program in a complementary (or applied) area to computer science, possibly forming a minor in that discipline area. A three-hour bridge course is included in the 21-24 hours. This course bridges between computer science and the secondary concentration discipline, which can be a computer science course or a course in the other discipline. The secondary concentration requirement is quite flexible and can be tailored to a student's interest upon the approval of his/her academic advisor. To illustrate this, here are two possibilities:

Business Secondary Concentration

ACCT 2121 Principles of Accounting I (3)
ACCT 2122 Principles of Accounting II (3)
ECON 2101 Principles of Economics—Macro (3)
ECON 2102 Principles of Economics—Micro (3)
INFO 3231 Business Applications Development (3)
INFO 3234 Business Information Systems Analysis and Design (3)
INFO 3236 Business Analytics (3)
or INFO 3240 eBusiness Systems (3)
ITCS 2231 Introduction to Business Programming (3)*

Cognitive Science Secondary Concentration

ITCS 3216 Introduction to Cognitive Science (3)*
ITIS 3130 Human Computer Interaction (3)
PSYC 3115 Sensation and Perception (3)
PSYC 3116 Human Cognitive Processes (3)

Plus three of the following:

ENGL 4161 Modern English Grammar (3)
ENGL 4167 The Mind and Language (3)
ENGL 4263 Linguistics and Language Learning (3)
ITIS 3131 Human and Computer Information Processing (3)
PSYC 3122 Cognitive and Language Development (3)
PSYC 3313 Neuropsychology (3)
PSYC 4316 Cognitive Neuroscience (3)

**Bridge course*

Technical Elective Courses (6 credit hours)

Select two additional ITCS or ITIS courses at the 3000 level or above.

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Department of Software and Information Systems

<http://sis.uncc.edu>

The Department of Software and Information Systems provides a range of courses and concentrations related to the design, management, and security of software systems with an emphasis on information technology. The department offers courses in information technology design and management; software systems design, architecture, integration, and implementation; human centered design and interaction, cyber security, health informatics, and intelligent and complex systems.

Degree Programs

The Department of Software and Information Systems offers both undergraduate and graduate programs. The undergraduate program leads either to a Bachelor of Arts (B.A.) or Bachelor of Science (B.S.) in Computer Science or a Minor in Software and Information Systems. The Software and Information Systems concentrations described below are technically part of the Computer Science major but for administrative and advising purposes, students completing these concentrations are members of the Department of Software and Information Systems.

The graduate program leads to a Master of Science (M.S.) in Information Technology (see the *UNC Charlotte Graduate Catalog* for information on the M.S. degree). Graduate certificate programs in Information Security and Privacy, Health Informatics, and Information Technology Management are also available. To assist with their studies, students have access to advanced computer labs and software where they can practice and experiment in controlled environments. In addition, the department maintains a high degree of interaction with working industry professionals who provide real-world expertise and experience.

Bachelor of Arts in Computer Science

~~Within the Department of Software and Information Systems, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Cyber Security, Financial Services Informatics, Information Technology, Software and Information Systems, Software Engineering, or Web Development. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas. The focus of these concentrations includes:~~

- ~~• Web and Mobile Applications Development~~
- ~~• Software Engineering (design, integration, testing, and assurance)~~
- ~~• Information Security and Privacy~~
- ~~• Human Computer Interaction~~
- ~~• IT Infrastructure Design~~
- ~~• Emerging Technology~~
- ~~• Financial Services Informatics~~

~~Under this program, the requirements for the B.A. degree may be fulfilled by completing the traditional program (i.e., the Concentration in Software and Information Systems) or any of the other five concentrations. The traditional program emphasizes advanced programming and mathematics skills. It is intended for students who have a general interest in information technology and who want to maintain maximum flexibility in course selection and job opportunity. The Concentration in Cyber Security emphasizes the detection and mitigation of security threats in information systems. The Concentration in Information Technology emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The Concentration in Software Engineering integrates mathematics and computer science to achieve classical engineering approaches to software system problem solving. The Concentration in Web Development emphasizes software development using Internet and World Wide Web technologies that are increasingly the default model for business customer interaction. These five concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.~~

~~A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106) and a course in ethics that addresses issues of information technology. A special section of LBST 2211 (Ethical Issues in Personal, Professional, and Public Life) will be designated as Ethical Issues: Technology (EI:T). Software and Information Systems students who complete this section of LBST 2211 (identified as ITIS 2211 for registration purposes) will fulfill both departmental and General Education Requirements for a course in ethical issues and cultural critique.~~

Computer Science, Cyber Security Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the General Education program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)

- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

[All concentrations in the B.S. in Computer Science include these core courses.](#)

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)
- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.

Capstone Course (3 credit hours)

Select one of the following:

- ITCS 4155 Software Development Projects (3 credits)
- ITCS 4650 Senior Project I (3 credits)
- ITCS 4651 Senior Project II (3 credits)
- ITCS 4990 Undergraduate Research (3 credits)
- ITCS 4991 Undergraduate Thesis (3 credits)

Cyber Security Concentration: Courses (27 credit hours)

Required Courses (27 credit hours)

- ITIS 2300+L - Web-Based Application Development (plus lab) (4 credits)
- ITIS 3200 - Introduction to Information Security and Privacy (3 credits)
- ITIS 3130 - Human-Computer Interaction (3 credits)
- ITIS 3110+L - IT Infrastructure: Design and Practice (4 credits)
- ITCS 3160 - Data Base Design and Implementation (3 credits)
- ITIS 4250 - Computer Forensics (3 credits)
- ITIS 4166 - Network-Based Application Development (3 credits)
- ITIS 4221 - Secure Programming and Penetration Testing (3 credits)
- ITIS 4420 - Usable Security & Privacy (3 credits)

Free Electives Courses (1 credit hour)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Software Engineering Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

[All concentrations in the B.S. in Computer Science include these core courses.](#)

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)
- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

[Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 credit hours)

[Select one of the following:](#)

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Software Engineering Concentration (27 credit hours)

Required Courses (27 credit hours)

- [ITIS 2300+L - Web-Based Application Development \(plus lab\) \(3 credits\)](#)
- [ITIS 3200 - Introduction to Information Security and Privacy \(3 credits\)](#)
- [ITIS 3130 - Human-Computer Interaction \(3 credits\)](#)
- [ITCS 3160 - Data Base Design and Implementation \(3 credits\)](#)
- [ITIS 3300 - Software Requirements and Project Management \(3 credits\)](#)
- [ITIS 3310 - Software Architecture and Design \(3 credits\)](#)
- [ITIS 3320 - Introduction to Software Testing and Assurance \(3 credits\)](#)
- [ITIS 4166 - Network-Based Application Development \(3 credits\)](#)
- [ITIS 4221 - Secure Programming and Penetration Testing \(3 credits\)](#)

Free Electives Courses (1 credit hour)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at \[academics.uncc.edu\]\(http://academics.uncc.edu\).](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

[By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.](#)

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

Computer Science, Web & Mobile Applications, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (40 credit hours)

For details on required courses refer to the [General Education](#) program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (10 credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

All concentrations in the B.S. in Computer Science include these core courses.

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)

- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

[Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 credit hours)

[Select one of the following:](#)

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Web & Mobile Applications Concentration (27 credit hours)

Required Courses (24 credit hours)

- [ITIS 2300+L - Web-Based Application Development \(plus lab\) \(3 credits\)](#)
- [ITIS 3200 - Introduction to Information Security and Privacy \(3 credits\)](#)
- [ITIS 3130 - Human-Computer Interaction \(3 credits\)](#)
- [ITCS 3160 - Data Base Design and Implementation \(3 credits\)](#)
- [ITIS 4180 - Mobile Application Development \(3 credits\)](#)
- [ITIS 4166 - Network-Based Application Development \(3 credits\)](#)
- [ITIS 4440 - Interactive Systems Design and Implementation \(3 credits\)](#)
- [ITIS 4221 - Secure Programming and Penetration Testing \(3 credits\)](#)

Technical Electives Courses (3 credit hours)

[Select an elective from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics.](#)

Free Electives Courses (1 credit hour)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

~~**Bachelor of Arts in Computer Science with Concentration in Cyber Security**~~

~~The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Cyber Security requires 121 credit hours.~~

~~**Degree Requirements**~~

~~**General Education Courses**~~

~~For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.~~

~~*Critical Thinking and Technology Ethics Courses*~~

PHIL 1106 Critical Thinking (3)
ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)

English and Communications Courses

UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)
or UWRT 1103 Accelerated College Writing and Rhetoric (3)
ENGL 2116 Introduction to Technical Communication (3) (W)
COMM 2105 Small Group Communication (3)

Mathematics and Statistics Courses

Select one of the following sequences:

Sequence 1

MATH 1120 Calculus (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 1220 Elements of Statistics I (BUSN) (3)
STAT 2223 Elements of Statistics II (3)

Sequence 2

MATH 1241 Calculus I (3)
MATH 1242 Calculus II (3)
MATH 2164 Matrices and Linear Algebra (3)
STAT 2122 Introduction to Probability and Statistics (3)

Major Courses (51 credit hours)

ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 2175 Logic and Algorithms (3)
ITCS 2214 Data Structures (3)
ITCS 2215 Design and Analysis of Algorithms (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)
ITIS 1600 Computing Professionals (1)
ITIS 2110 IT Infrastructure I: Design and Practice (3)
ITIS 2110L IT Infrastructure I: Design and Practice Lab (0)
ITIS 2300 Web-Based Application Development (3)
ITIS 3110 IT Infrastructure I: Design and Practice (3)
ITIS 3110L IT Infrastructure I: Design and Practice Lab (0)
ITIS 3130 Human-Computer Interaction (3)
ITIS 3200 Introduction to Information Security and Privacy (3)
ITIS 3300 Software Requirements and Project Management (3)
ITIS 4166 Network-Based Application Development (3)
ITIS 4221 Secure Programming and Penetration Testing (3)
ITIS 4250 Computer Forensics (3)

Restricted Elective Courses (6 credit hours)

Select approved ITIS or ITCS courses numbered 3000 or above.

Unrestricted Elective Courses (15 credit hours)

Students must complete at least 15 credit hours in a concentration of courses that form a coherent body of study related to developing applications of information systems. At least six of the 15 hours must be upper division courses. These courses must be completed in a major outside of the College of Computing and Informatics and require approval of the student's academic advisor.

~~Degree Total = 121 Credit Hours~~

~~Suggested Curriculum~~

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

~~Bachelor of Arts in Computer Science with Concentration in Financial Services Informatics~~

~~The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Financial Services Informatics requires 120 credit hours.~~

~~Degree Requirements~~

~~General Education Courses~~

~~For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.~~

~~Critical Thinking and Technology Ethics Courses~~

~~PHIL 1106 Critical Thinking (3)~~

~~LBST 2211 Ethical Issues in Personal, Professional, and Public Life (3)~~

~~English and Communications Courses~~

~~UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)~~

~~or UWRT 1103 Accelerated College Writing and Rhetoric (3)~~

~~ENGL 2116 Introduction to Technical Communication (3) (W)~~

~~COMM 2105 Small Group Communication (3)~~

~~Mathematics and Statistics Courses~~

~~MATH 1120 Calculus (3)~~

~~STAT 1220 Elements of Statistics I (BUSN) (3)~~

~~STAT 2223 Elements of Statistics II (3)~~

~~Major Courses (38 credit hours)~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

~~ITCS 1213L Programming Lab II (0)~~

~~ITCS 2301 Financial Services Computing Environment (3)~~

~~or ITIS 2301 Financial Services Computing Environment (3)~~

~~ITCS 3155 Software Engineering (3)~~

~~ITCS 3160 Database Design and Implementation (3)~~

~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~

~~ITIS 1210 Introduction to Web-Based Information Systems (3)~~

~~ITIS 2300 Web-Based Application Development (3)~~

~~ITIS 3130 Human-Computer Interaction (3)~~

~~ITIS 3200 Introduction to Information Security and Privacy (3)~~

~~ITIS 3300 Software Requirements and Project Management (3)~~

~~ITIS 4220 Vulnerability Assessment and Systems Assurance (3)~~

~~Concentration Courses (27 credit hours)~~

~~ACCT 2121 Principles of Accounting I (3)~~

~~ACCT 2122 Principles of Accounting II (3)~~

~~ECON 2101 Principles of Economics—Macro (3)
ECON 2102 Principles of Economics—Micro (3)
FINN 3120 Financial Management (3)
FINN 3221 Financial Institutions and Markets (3)
FINN 3226 Financial Theory and Practice (3)
FTIS 1301 Introduction to the Financial Services Industry (3)
 or ITCS 1301 Introduction to the Financial Services Industry (3)
FTIS 3301 Introduction to the Regulatory Environment for Financial Services Firms (3)
 or ITCS 3301 Introduction to the Regulatory Environment for Financial Services Firms (3)~~

Capstone Courses (6 credit hours)

Select one of the following sequences:

Sequence 1

~~FTIS 4640 Financial Services Informatics Industry Foundations Capstone I (3)
FTIS 4641 Financial Services Informatics Industry Foundations Capstone II (3)~~

Sequence 2

~~ITCS 4640 Financial Services Informatics Industry Foundations Capstone I (3)
ITCS 4641 Financial Services Informatics Industry Foundations Capstone II (3)~~

Degree Total = 120 Credit Hours

Suggested Curriculum

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

Computer Science, Human-Computer Interaction Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas.

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The Concentration in Information Technology, offered by the Software and Information Systems Department, emphasizes usability, security, and reliability of IT

infrastructures, as well as writing and communications skills. The Concentration in Human-Computer Interaction, offered by the Software and Information Systems Department, emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics, offered by the Computer Science Department, is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the [General Education program](#). Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1120 - Calculus \(3 credits\)](#)
- [STAT 1220 - Elements of Statistics I \(3 credits\)](#)

Inquiry into the Sciences (10 Credit hours)

- [XXXX XXXX - Natural Science with Lab \(General Education Requirement\) \(4 credits\)](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 Credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)

- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (39 credit hours)

Core Courses (15 credit hours)

[All concentrations in the B.A. in Computer Science include these core courses.](#)

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)

Critical Thinking (3 credits)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (3 credits)

- [STAT 2223 - Elements of Statistics II \(3 credits\)](#)

Related Area (15 Credit hours)

[Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 Credit hours)

[Select one of the following:](#)

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Human-Computer Interaction Concentration Courses (39 Credit hours)

Core Courses (24 Credit hours)

- [ITIS 3130 - Human-Computer Interaction \(3 credits\)](#)
- [ITIS 2300+L - Web-Based Application Development \(plus lab\) \(3 credits\)](#)

- [ITIS 3150 - Rapid Prototyping & Interface Building \(3 credits\)](#)
- [ITIS 3200 - Introduction to Information Security and Privacy \(3 credits\)](#)
- [ITCS 3216 - Introduction to Cognitive Science \(3 credits\)](#)
- [ITIS 4011 - Interaction Design Studio \(3 credits\)](#)
- [ITIS 4180 - Mobile Application Development \(3 credits\)](#)
- [ITIS 4440 - Interactive Systems Design and Implementation \(3 credits\)](#)

Writing Courses (6 Credit hours)

[This concentration requires an additional 6 credits in writing intensive courses. This requirement may be satisfied using any one of many intensive writing courses available at the university.](#)

Technical Electives Courses (9 Credit hours)

[Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics, excluding the courses listed above.](#)

Free Electives Courses (2 Credit hours)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at \[academics.uncc.edu\]\(http://academics.uncc.edu\).](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the program page.

Computer Science, Information Technology Concentration, B.A.

Within the College of Computing and Informatics, the requirements of the Bachelor of Arts (B.A.) in Computer Science are fulfilled by completing specific concentrations of courses designed for students interested in pursuing a career in Financial Services Informatics, Human-Computer Interaction, or Information Technology. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in related areas.

The Bachelor of Arts program requires a compact set of a computer science core (15 hours). In addition to one of three primary computer science concentrations, it also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.A. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies. The emphasis in this program is less theoretical/mathematical, and more on the applied side of computing.

Under this program, the requirements for the B.A. degree may be fulfilled by completing any of three concentrations. The Concentration in Information Technology, offered by the Software and Information Systems Department, emphasizes usability, security, and reliability of IT infrastructures, as well as writing and communications skills. The Concentration in Human-Computer Interaction, offered by the Software and Information Systems Department, emphasizes the design, development, and implementation of interactive systems from a human-centric perspective. These two concentrations prepare students for a wide variety of jobs or graduate studies. The Concentration in Financial Services Informatics, offered by the Computer Science Department, is designed to meet the needs of the financial services sector with a unique combination of finance and information technology courses, industry internships, and sponsored capstone projects.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106) and a course in ethics that addresses issues of information technology. The course ITIS 2211 Ethical Issues in Personal, Professional, and

Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique.

Degree Requirements

General Education (40 Credit hours)

For details on required courses refer to the General Education program. Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 Credit hours)

- UWRT 1101 - Writing and Inquiry in Academic Contexts I (3 credits)
- UWRT 1102 - Writing and Inquiry in Academic Contexts II (3 credits)
- MATH 1120 - Calculus (3 credits)
- STAT 1220 - Elements of Statistics I (3 credits)

Inquiry into the Sciences (10 Credit hours)

- XXXX XXXX - Natural Science with Lab (General Education Requirement) (4 credits)
- XXXX XXXX - Natural Science (General Education Requirement) (3 credits)
- XXXX XXXX - Social Science (General Education Requirement) (3 credits)

Liberal Education for Private and Public Life (12 Credit hours)

- LBST 110X - LBST 1100 Series: Arts and Society (3 credits)
- LBST 2101 - Western Cultural and Historical Awareness (3 credits)
- LBST 2102 - Global and Intercultural Connections (3 credits)
- ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology (3 credits) - Fulfills LBST 22xx requirement

Communication Skills Courses (6 credits)

- ENGL 2116 – Introduction to Technical Communication (3 credits)
- ITCS 3688 - Computers and Their Impact on Society (3 credits) - fulfills the requirement of writing within the discipline and the oral communication requirement

Major Requirements (39 credit hours)

Core Courses (15 credit hours)

All concentrations in the B.A. in Computer Science include these core courses.

- ITSC 1212/L - Introduction to Computer Science I (4 credits)
- ITSC 1213/L - Introduction to Computer Science II (4 credits)

- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)

Critical Thinking (3 credits)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (3 credits)

- [STAT 2223 - Elements of Statistics II \(3 credits\)](#)

Related Area (15 Credit hours)

[Select 15 credit hours of electives in related courses. The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 Credit hours)

[Select one of the following:](#)

- [ITCS 4155 Software Development Projects \(3 credits\)](#)
- [ITCS 4650 Senior Project I \(3 credits\)](#)
- [ITCS 4651 Senior Project II \(3 credits\)](#)
- [ITCS 4990 Undergraduate Research \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Information Technology Concentration Courses (39 Credit hours)

Core Courses (27 Credit hours)

- [ITIS 3130 - Human-Computer Interaction \(3 credits\)](#)
- [ITIS 2300+L - Web-Based Application Development \(plus lab\) \(3 credits\)](#)
- [ITCS 3160 - Data Base Design and Implementation \(3 credits\)](#)
- [ITIS 3200 - Introduction to Information Security and Privacy \(3 credits\)](#)
- [ITIS 3300 - Software Requirements and Project Management \(3 credits\)](#)
- [ITSC 3155 - Software Engineering \(3 credits\)](#)
- [ITIS 3310 - Software Architecture and Design \(3 credits\)](#)
- [ITIS 3320 - Introduction to Software Testing and Assurance \(3 credits\)](#)
- [ITIS 4420 - Usable Security & Privacy \(3 credits\)](#)

Writing Courses (6 Credit hours)

This concentration requires an additional 6 credits in writing intensive courses. This requirement may be satisfied using any one of many intensive writing courses available at the university.

- XXXX XXXX - Technical writing and communication (3 credits)
- XXXX XXXX - Technical writing and communication (3 credits)

Technical Electives Courses (6 Credit hours)

Select two electives from the 3000- or 4000- levels of courses offered by the College of Computing and Informatics, excluding the courses listed above.

Free Electives Courses (2 Credit hours)

Select any course offered by the University as needed to complete 120 hours total.

Degree Total (120 Credit hours)

Additional Program and Opportunities

Suggested Curriculum

For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Experiential Learning and Service Opportunities

Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.

Cooperative Education Program

By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.

Honors Program

For details about the College of Computing and Informatics Honors Program, visit the [program page](#).

~~Bachelor of Arts in Computer Science with Concentration in Information Technology~~

~~The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Information Technology requires 120 credit hours.~~

~~Degree Requirements~~

~~General Education Courses~~

~~For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.~~

~~Critical Thinking and Technology Ethics Courses~~

~~PHIL 1106 Critical Thinking (3)~~

~~ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~

~~English and Communications Courses~~

~~UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)~~

~~or UWRT 1103 Accelerated College Writing and Rhetoric (3)~~

~~ENGL 2116 Introduction to Technical Communication (3) (W)~~

~~COMM 2100 Introduction to Communication Theory (3)~~

~~COMM 2105 Small Group Communication (3)~~

~~Mathematics and Statistics Courses~~

~~MATH 1100 College Algebra and Probability (3)~~

~~or MATH 1103 Precalculus Mathematics for Science and Engineering (3)~~

~~STAT 1220 Elements of Statistics I (BUSN) (3)~~

~~Major Courses~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

~~ITCS 1213L Programming Lab II (0)~~

~~ITCS 3160 Database Design and Implementation (3)~~

~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~

~~ITIS 1600 Computing Professionals (1)~~

~~ITIS 2110 IT Infrastructure I: Design and Practice (3)~~

~~ITIS 2110L IT Infrastructure I: Design and Practice Lab (0)~~

~~ITIS 2300 Web-Based Application Development (3)~~

~~ITIS 3110 IT Infrastructure II: Design and Practice (3)~~

~~ITIS 3110L IT Infrastructure II: Design and Practice Lab (0)~~

~~ITIS 3130 Human-Computer Interaction (3)~~

~~ITIS 3200 Introduction to Information Security and Privacy (3)~~

~~ITIS 3300 Software Requirements and Project Management (3)~~

~~ITIS 3320 Introduction to Software Testing and Assurance (3)~~

~~Concentration Courses~~

~~ENGL 4181 Writing and Designing User Documents (3)~~

~~or ENGL 4183 Editing with Digital Technologies (3)~~

~~ENGL 4182 Information Design and Digital Publishing (3)
or COMM 3141 Organizational Communication (3)~~

Restricted Elective Courses (6 credit hours)

Select approved ITIS or ITCS courses numbered 3000 or above.

Unrestricted Elective Courses (21 credit hours)

In addition, each student, in consultation with his or her academic advisor, must complete at least 21 credit hours by either:

- ~~1) Completing the requirements for a minor chosen by the student even if doing so requires more than 21 hours (if the minor can be completed in less than 21 hours, the remaining hours become unrestricted electives) **OR**~~
- ~~2) Completing a series of courses in a major that does not offer a minor. These courses must form a coherent body of study related to developing applications of information systems. The courses selected must include a minimum of 9 hours of upper-division courses.~~

~~In completing this requirement, students must comply with all prerequisites and other applicable academic regulations for courses offered by any department, even if doing so requires exceeding the 120-credit-hour minimum necessary for graduation.~~

Degree Total = 120 Credit Hours

Suggested Curriculum

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

~~Bachelor of Arts in Computer Science with Concentration in Software and Information Systems~~

~~The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Software and Information Systems requires 120 credit hours.~~

Degree Requirements

General Education Courses

~~For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.~~

Critical Thinking and Technology Ethics Courses

~~PHIL 1106 Critical Thinking (3)~~

~~ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~

English and Communications Courses

~~UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)~~

~~or UWRT 1103 Accelerated College Writing and Rhetoric (3)~~

~~ENGL 2116 Introduction to Technical Communication (3) (W)~~

~~COMM 2105 Small Group Communication (3)~~

Mathematics and Statistics Courses

~~Select one of the following sequences:~~

Sequence 1

~~MATH 1120 Calculus (3)~~

~~MATH 2164 Matrices and Linear Algebra (3)~~

~~STAT 1220 Elements of Statistics I (BUSN) (3)~~

~~STAT 2223 Elements of Statistics II (3)~~

Sequence 2

~~MATH 1241 Calculus I (3)~~

~~MATH 1242 Calculus II (3)~~

~~MATH 2164 Matrices and Linear Algebra (3)~~

~~STAT 2122 Introduction to Probability and Statistics (3)~~

Major Courses

~~ITIS 1600 Computing Professionals (1)~~

~~ITIS 2110 IT Infrastructure I: Design and Practice (3)~~

~~ITIS 2110L IT Infrastructure I: Design and Practice Lab (0)~~

~~ITIS 2300 Web Based Application Development (3)~~

~~ITIS 3200 Introduction to Information Security and Privacy (3)~~

~~ITIS 3300 Software Requirements and Project Management (3)~~

~~ITIS 3310 Software Architecture and Design (3)~~

~~ITIS 3320 Introduction to Software Testing and Assurance (3)~~

~~ITIS 4166 Network Based Application Development (3)~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

~~ITCS 1213L Programming Lab II (0)~~

~~ITCS 2175 Logic and Algorithms (3)~~

~~ITCS 2214 Data Structures (3)~~

~~ITCS 2215 Design and Analysis of Algorithms (3)~~

~~ITCS 3160 Database Design and Implementation (3)~~

~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~

Restricted Elective Courses (9 credit hours)

Select approved ITIS or ITCS courses numbered 3000 or above.

Concentration Courses (15 credit hours)

Students must complete at least 15 credit hours in a concentration of courses that form a coherent body of study related to developing applications of information systems. At least six of the 15 hours must be upper-division courses. These courses must be completed in a major outside of the College of Computing and Informatics and require approval of the student's academic advisor.

Degree Total = 120 Credit Hours

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Bachelor of Arts in Computer Science with Concentration in Software Engineering

The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Software Engineering requires 120 credit hours.

Degree Requirements

General Education Courses

For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.

Critical Thinking and Technology Ethics Courses

~~PHIL 1106 Critical Thinking (3)~~

~~FTIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)~~

English and Communications Courses

~~UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)~~

~~or UWRT 1103 Accelerated College Writing and Rhetoric (3)~~

~~ENGL 2116 Introduction to Technical Communication (3) (W)~~

~~COMM 2105 Small Group Communication (3)~~

Mathematics and Statistics Courses

Select one of the following sequences:

Sequence 1

~~MATH 1120 Calculus (3)~~

~~MATH 2164 Matrices and Linear Algebra (3)~~

~~STAT 1220 Elements of Statistics I (BUSN) (3)~~

~~STAT 2223 Elements of Statistics II (3)~~

Sequence 2

~~MATH 1241 Calculus I (3)~~

~~MATH 1242 Calculus II (3)~~

~~MATH 2164 Matrices and Linear Algebra (3)~~

~~STAT 2122 Introduction to Probability and Statistics (3)~~

Major Courses (51 credit hours)

~~FTIS 1600 Computing Professionals (1)~~

~~FTIS 2110 IT Infrastructure I: Design and Practice (3)~~

~~FTIS 2110L IT Infrastructure I: Design and Practice Lab (0)~~

~~FTIS 2300 Web Based Application Development (3)~~

~~FTIS 3130 Human Computer Interaction (3)~~

~~FTIS 3150 Rapid Prototyping and Interface Building (3)~~

~~FTIS 3200 Introduction to Information Security and Privacy (3)~~

~~FTIS 3300 Software Requirements and Project Management (3)~~

~~FTIS 3310 Software Architecture and Design (3)~~

~~FTIS 3320 Introduction to Software Testing and Assurance (3)~~

~~ITCS 1212 Introduction to Computer Science I (4)~~

~~ITCS 1212L Programming Lab I (0)~~

~~ITCS 1213 Introduction to Computer Science II (4)~~

~~ITCS 1213L Programming Lab II (0)~~

~~ITCS 2175 Logic and Algorithms (3)~~

~~ITCS 2214 Data Structures (3)~~

~~ITCS 2215 Design and Analysis of Algorithms (3)~~

~~ITCS 3160 Database Design and Implementation (3)~~

~~ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~

~~ITCS 4155 Software Development Projects (3)~~

Concentration Courses (15 credit hours)

Students must complete at least 15 credit hours in a concentration of courses that form a coherent body of study related to developing applications of information systems. At least six of the 15 hours must be upper division courses. These courses must be completed in a major outside the College of Computing and Informatics and require approval of the student's academic advisor.

Degree Total = 120 Credit Hours

Suggested Curriculum

For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.

Bachelor of Arts in Computer Science with Concentration in Web Development

The Bachelor of Arts (B.A.) in Computer Science with a Concentration in Web Development requires 120 credit hours.

Degree Requirements

General Education Courses

For details on required courses, refer to the General Education program. Students in this major should plan on taking the following courses that meet general education and major requirements.

Critical Thinking and Technology Ethics Courses

PHIL 1106 Critical Thinking (3)

ITIS 2211 Ethical Issues in Personal, Professional, and Public Life: Technology (3)

English and Communications Courses

UWRT 1101 Writing and Inquiry in Academic Contexts I (3) and UWRT 1102 Writing and Inquiry in Academic Contexts II (3)

or UWRT 1103 Accelerated College Writing and Rhetoric (3)

ENGL 2116 Introduction to Technical Communication (3) (W)

COMM 2105 Small Group Communication (3)

Mathematics and Statistics Courses

Select one of the following sequences:

Sequence 1

MATH 1120 Calculus (3)

MATH 2164 Matrices and Linear Algebra (3)

STAT 1220 Elements of Statistics I (BUSN) (3)

STAT 2223 Elements of Statistics II (3)

Sequence 2

MATH 1241 Calculus I (3)

MATH 1242 Calculus II (3)

MATH 2164 Matrices and Linear Algebra (3)

STAT 2122 Introduction to Probability and Statistics (3)

Major Courses

ITIS 1600 Computing Professionals (1)

ITIS 2110 IT Infrastructure I: Design and Practice (3)

ITIS 2110L IT Infrastructure I: Design and Practice Lab (0)

ITIS 2300 Web-Based Application Development (3)

ITIS 3105 Server-Side Applications and Data Management (3)

ITIS 3110 IT Infrastructure II: Design and Practice (3)

ITIS 3110L IT Infrastructure II: Design and Practice Lab (0)

ITIS 3130 Human-Computer Interaction (3)

ITIS 3150 Rapid Prototyping and Interface Building (3)

ITIS 3200 Introduction to Information Security and Privacy (3)

ITIS 3300 Software Requirements and Project Management (3)

~~ITIS 4166 Network Based Application Development (3)
ITIS 4170 Advanced Client Applications (3)
ITIS 4221 Secure Programming and Penetration Testing (3)
ITCS 1212 Introduction to Computer Science I (4)
ITCS 1212L Programming Lab I (0)
ITCS 1213 Introduction to Computer Science II (4)
ITCS 1213L Programming Lab II (0)
ITCS 2214 Data Structures (3)
ITCS 3160 Database Design and Implementation (3)
ITCS 3688 Computers and Their Impact on Society (3) (O, W)~~

~~Restricted Elective Courses (6 credit hours)~~

~~Select from approved ITIS or ITCS courses numbered 3000 or above.~~

~~Concentration Courses (15 credit hours)~~

~~Students must complete at least 15 credit hours in a concentration of courses that form a coherent body of study related to developing applications of information systems. At least six of the 15 hours must be upper-division courses. These courses must be completed in a major outside the College of Computing and Informatics and require approval of the student's academic advisor.~~

~~Degree Total = 120 Credit Hours~~

~~Suggested Curriculum~~

~~For a suggested curriculum progression toward completing the major, please see the Academic Plan of Study available online at academics.uncc.edu.~~

Department of Bioinformatics and Genomics

Research within the [Department of Bioinformatics and Genomics](#) encompasses both Bioinformatics and Computational Biology, as defined by the National Institutes of Health (NIH). Our mission is to promote the development, use, and commercialization of novel computational approaches to help solve important biological problems, and to provide training in the science and technology that underlies them.

The Department of Bioinformatics and Genomics offers [undergraduate students a Bachelor of Science \(B.S.\) in Computer Science and a minor in Bioinformatics and Genomics](#) ~~for undergraduate students~~. Designed to introduce students to the collection, informatics analysis and interpretation of data derived from genomic and biological macromolecular investigations, this minor field of study will provide students with a foundation of understanding and the computing skill necessary to communicate in the increasingly data-centric life sciences. In addition to gaining first-hand experience with current technologies for high-throughput data generation, students will receive training in up-to-date methods for data handling and interpretation while developing an understanding of critical issues in bioinformatics research design, statistical data analysis, and the application of genomics domain knowledge.

In addition to the [undergraduate programs](#) ~~Minor in Bioinformatics and Genomics~~, the department offers graduate programs and degrees. See the *UNC Charlotte Graduate Catalog* for details.

Computer Science, Bioinformatics Concentration, B.S.

Within the College of Computing and Informatics, the requirements of the Bachelor of Science (B.S.) in Computer Science are fulfilled by completing specific concentrations of courses offered by the three different departments in the College of Computing and Informatics and designed for students interested in pursuing a career in computing. The B.S. offers a broad core of computing subjects and allows in-depth study in one of the concentration available:

- [AI, Robotics & Gaming \(Department of Computer Science\)](#)
- [Bioinformatics \(Department of Bioinformatics and Genomics\)](#)
- [Cyber Security \(Department of Software and Information Systems\)](#)
- [Data Science \(Department of Computer Science\)](#)
- [Software Engineering \(Department of Software and Information Systems\)](#)
- [Software, Systems & Networks \(Department of Computer Science\)](#)
- [Web & Mobile Applications \(Department of Software and Information Systems\)](#)

The B.S. program requires a common set of a computer science courses (25 credit hours). It also requires 15 credit hours of a second concentration in a non-computer science discipline, satisfied by a second major, a minor, or a set of coordinated courses developed through consultation with an advisor. Graduates from the B.S. program are thus expected to have knowledge and skill in computer science plus a complementary discipline to which computing applies.

A common feature of this degree program is that students in all concentrations must complete a course in critical thinking (PHIL 1106). In addition, the course ITIS 2211 Ethical Issues in Personal, Professional, and Public Life satisfies the requirement of the LBST 2211 and fulfills both departmental and General Education Requirements for a course in ethical issues and cultural critique. These concentrations are designed to best prepare students to match the diverse requirements of employers. It also prepares students to pursue graduate studies in computing and other related areas.

Degree Requirements

General Education (36 credit hours)

For details on required courses refer to the [General Education program](#). Students majoring in Computer Science should plan on taking the following courses that meet general education and major requirements:

Fundamental Skills of Inquiry (12 credit hours)

- [UWRT 1101 - Writing and Inquiry in Academic Contexts I \(3 credits\)](#)
- [UWRT 1102 - Writing and Inquiry in Academic Contexts II \(3 credits\)](#)
- [MATH 1241 - Calculus I \(3 credits\)](#)
- [MATH 1242 - Calculus II \(3 credits\)](#)

Inquiry into the Sciences (6 credit hours)

- [Natural Science + Lab Gen Ed requirement is fulfilled by concentration course](#)
- [XXXX XXXX - Natural Science \(General Education Requirement\) \(3 credits\)](#)
- [XXXX XXXX - Social Science \(General Education Requirement\) \(3 credits\)](#)

Liberal Education for Private and Public Life (12 credit hours)

- [LBST 110X - LBST 1100 Series: Arts and Society \(3 credits\)](#)
- [LBST 2101 - Western Cultural and Historical Awareness \(3 credits\)](#)
- [LBST 2102 - Global and Intercultural Connections \(3 credits\)](#)
- [ITIS 2211 – Ethical Issues in Personal, Professional, and Public Life: Technology \(3 credits\) - Fulfills LBST 22xx requirement](#)

Communication Skills Courses (6 credits)

- [ENGL 2116 – Introduction to Technical Communication \(3 credits\)](#)
- [ITCS 3688 - Computers and Their Impact on Society \(3 credits\) - fulfills the requirement of writing within the discipline and the oral communication requirement](#)

Major Requirements (52 credit hours)

Core Courses (25 credit hours)

[All concentrations in the B.S. in Computer Science include these core courses.](#)

- [ITSC 1212/L - Introduction to Computer Science I \(4 credits\)](#)
- [ITSC 1213/L - Introduction to Computer Science II \(4 credits\)](#)
- [ITSC 1600 - Computing Professionals \(1 credit\)](#)
- [ITSC 2175 - Logic and Algorithms \(3 credits\)](#)
- [ITSC 2214 - Data Structures and Algorithms \(3 credits\)](#)
- [ITSC 3146 Operating Systems and Networking \(3 credits\)](#)
- [ITSC 3155 Software Engineering \(3 credits\)](#)
- [ITSC 3181/L Introduction to Computer Architecture \(4 credits\)](#)

Critical Thinking (3 credit hours)

- [PHIL 1106 – Critical Thinking \(3 credits\)](#)

Additional Required Courses (6 credit hours)

- [STAT 2122 - Introduction to Probability and Statistics \(3 credits\)](#)
- [MATH 2164 - Matrices and Linear Algebra \(3 credits\)](#)

Related Area (15 credit hours)

Select 15 credit hours of electives in related courses. [The requirement may also be satisfied by a second major or a minor. Students should select courses in consultation with the department and/or their advisor.](#)

Capstone Course (3 credit hours)

Select one of the following:

- [BINF 4650 - Senior Project \(3 credits\)](#)
- [ITCS 4991 Undergraduate Thesis \(3 credits\)](#)

Bioinformatics Concentration: Courses (21-22 credit hours)

Required Courses (12 credit hours)

- [BINF1101+L Introduction to Bioinformatics and Genomics \(4 credits\) \(Fulfills the Natural Science + Lab Gen. Ed. requirement\)](#)
- [BINF 2111+L Introduction to Bioinformatics Computing \(4 credits\)](#)
- [BINF 3101+L Sequence Analysis \(3 credits\)](#)
- [BINF 4600 Bioinformatics Seminar \(1 credits\)](#)

Subarea 1: Database/Analytics (3 credit hours)

Choose one course from the list below

- [BINF 3121 Statistics for Bioinformatics \(3 credits\)](#)
- [BINF 3211 Bioinformatics Database and Mining Technologies \(3 credits\)](#)
- [BINF 4211 Applied Data Mining for Bioinformatics \(3 credits\)](#)

Subarea 2: Professional Development (3 credit hours)

Choose one course from the list below

- [BINF 4171 Business of Biotechnology \(3 credits\)](#)
- [BINF4191 Life Sciences and the Law \(3 credits\)](#)

Subarea 3: Upper Division Elective (3-4 credit hours)

Choose one course from list below

- [BINF 3201+L Genomics Methods \(4 credits\)](#)
- [BINF 4101 Computational Systems Biology \(3 credits\)](#)

- [BINF 4111 Structural Bioinformatics \(3 credits\)](#)

Free Electives Courses (10-11 credit hours)

[Select any course offered by the University as needed to complete 120 hours total.](#)

Degree Total (120 credit hours)

Additional Program and Opportunities

Suggested Curriculum

[For a suggested curriculum for this degree to map out a path toward completing the major, please see the Academic Plan of Study available online at \[academics.uncc.edu\]\(http://academics.uncc.edu\).](#)

Experiential Learning and Service Opportunities

[Students are encouraged to participate in professional work experiences in support of their academic and career development through the cooperative education, 49ership, internship, and service programs offered to them. The College works with the University Career Center to expand experiential learning offerings to enable more students to graduate with career-related experience. For more information about experiential learning opportunities, please see the University Career Center section in this *Catalog*.](#)

Cooperative Education Program

[By participating in the Cooperative Education program, students in Computer Science may pursue their education along with alternating semesters of full-time work experiences so that they may be better prepared to enter their chosen professional career. Interested students should contact the University Career Center for more information.](#)

Honors Program

[For details about the College of Computing and Informatics Honors Program, visit the \[program page\]\(#\).](#)

ITCS ITSC 1212 - Introduction to Computer Science I

Credit Hours: (4)

~~Introduction to algorithmic problem-solving strategies and algorithm development; basic concepts and terminology of computers; study of data representation and number systems; use of computers to implement numerical and symbolic algorithms. General programming concepts~~

~~will be taught through the use of a high-level language. The course grade includes the student's performance in ITCS 1212L.~~

Introduction to problem-solving using Java including basic computer concepts; source & object code; elements of a programming language; numbering systems; assignment, arithmetic, logical, and relational operations; data types; expressions; variables, constants, and literals; naming conventions; reserved words; program flow; arrays; file I/O; object-oriented concepts (classes, objects, and methods); and problem-solving techniques. Four (4) credit hours.

Pre-requisite(s): ~~None~~ MATH 1100, MATH 1103, MATH 1120, or MATH 1241.

Co-requisite(s): ITSC 1212L. The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade. ~~MATH 1100, MATH 1103, MATH 1120, or MATH 1241.~~

ITIS 1212 - Introduction to Media Programming

~~Credit Hours: (3)~~

~~Java programming.~~

ITCS ITSC 1213 - Introduction to Computer Science II

Credit Hours: (4)

~~An advanced study of programming based on object-oriented concepts. This course extends the fundamentals studies in ITCS 1212. Concepts are taught by means of an in-depth study of an object-oriented language. The course grade includes the student's performances in ITCS 1213L.~~
Advanced topics in Java including version control, use of debuggers, class design, aggregation and association, exception handling, generic and abstract types, inheritance, polymorphism, interfaces, and abstract classes.

Pre-requisite(s): ~~ITCS 1212 with grade of C or above, or permission of department.~~

Co-requisite(s): ITSC 1213L. The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade.

ITCS ITSC 1600 - Computing Professionals

Credit Hours: (1)

~~This required course should be taken by all Freshman and Transfer students during their first semester in the College of Computing and Informatics. It is designed to assist with the intellectual and social transition from high school or community college to university by increasing the involvement of students in the intellectual life on campus and within the professional computing community; providing an orientation to resources available to students; promoting oral and writing skills; and enabling students to develop a personal education plan. The course has three components: a seminar series, peer group engagement, and extra-curricular engagement. Course grades are based on participation in all three components, quality of written reflections on all three components, and peer and instructor review of individual performance in~~

~~peer group engagement activities, including the development of a personal education plan. May not be repeated for grade replacement.~~

This course serves as an introduction on how to become a computing professional. Students will learn about setting goals, defining their dream career, becoming a part of the university, planning coursework, building network, managing time, and working in a team. Additionally, guest speakers and industry panels discuss and explain aspects of a professional career in IT related fields. Throughout this course, students build a professional profile including their goals, values, dream career, student organizations, coding skills, communication skills, curriculum plan, professional network, a team TED talk, resume, and a 30-second elevator pitch.

Pre-requisite(s): None.

ITIS 1600 - Computing Professionals

Credit Hours: (1)

~~This required course should be taken by all Freshman and Transfer students during their first semester in the College of Computing and Informatics. It is designed to assist with the intellectual and social transition from high school or community college to university by increasing the involvement of students in the intellectual life on campus and within the professional computing community; providing an orientation to resources available to students; promoting oral and writing skills; and enabling students to develop a personal education plan. The course has three components: a seminar series, peer group engagement, and extra-curricular engagement. Course grades are based on participation in all three components, quality of written reflections on all three components, and peer and instructor review of individual performance in peer group engagement activities, including the development of a personal education plan. May not be repeated for grade replacement.~~

ITCS ITSC 2175 - Logic and Algorithms

Credit Hours: (3)

This course provides a study of discrete mathematical concepts. Introduction to propositional calculus, predicate calculus, algorithms, logic functions, finite-state machines; logic design.

Pre-requisite(s): ITCS 1212; and MATH 1120 or MATH 1241.

ITCS ITSC 2214 - Data Structures and Algorithms

Credit Hours: (3)

A study of the theory and implementation of abstract data types (ADTs) including stacks, queues, and both general purpose and specialized trees and graphs. ~~Programming emphasis is on the use of an object-oriented language to implement algorithms related to the various data structures studied including creation, searching, and traversal of ADTs.~~ The course includes the implementation and analysis of algorithms related to the various data structures studied including creation, searching, and traversal of ADTs.

Pre-requisite(s): ITCS 1213 and ITCS 1213L with grades of C or above, ~~or permission of department.~~

ITCS ITSC 3146 - Introduction to Operating Systems and Networking

Credit Hours: (3)

Introduces the fundamentals of operating systems together with the basics of networking and communications. Topics include: processes, thread, [scheduling](#), cache, memory management, ~~virtual memory, concurrency, assembly language~~, [file systems](#), [interprocess communication](#), network architecture and protocols, ~~web and~~ HTTP, [MAC, IP, TCP/UPD](#) ~~and TCP~~, internet routing.

Pre-requisite(s): [ITSC 1213](#) ~~ITCS 2215 or permission of department.~~

ITCS ITSC 3155 - Software Engineering

Credit Hours: (3)

~~The system development cycle is examined in detail from the aspects of software engineering. Current tools and techniques of software systems development—the Agile development model, test-driven development, design patterns, and current software development frameworks—are taught and presented in conjunction with case studies and class problems.~~

[This course provides an introduction to software engineering, which advances the study and application of engineering principles, methods, and techniques that can help us to improve the process of creating software as well as the resulting software products. The course covers fundamentals of software engineering, including: modern software process models; eliciting, specifying, and evaluating software system requirements; designing software systems to embody required quality attributes, including usability and security; an introduction to reusable software design solutions in the form of software architectural styles and design patterns; software system modeling, implementation, and deployment; and software quality assurance \(measurement, inspection, testing\). Project planning, working in teams, and using modern software development tools will also be explored.](#)

Pre-requisite(s): [ITSC 2214](#). ~~ITCS 2215 or permission of department.~~

ITCS ITSC 3181+L - Introduction to Computer Architecture—~~Logic and Computer Systems~~

Credit Hours: (4)

~~Fundamental layers of digital computer systems: Switch level network structure; digital logic level including ALU, registers, buses; microprogramming level; conventional Instruction Set Architecture level and assembly language; memory organization and architecture; pipelining and functional parallelism.~~

[Introduces the fundamentals of computer architectures and their programmability using assembly and system programming. Topics include: logic design, processor architecture, memory hierarchies, assembly programming, C programming, process and thread parallelism.](#)

Pre-requisite(s): [ITSC 1213](#) and [ITSC 1213L](#) and [ITSC 2175](#) with grade of C or better ~~ITCS 2175 and ITCS 2215.~~

Co-requisite(s): [ITSC 3181L](#). [The lab is mandatory component of the course, not a separate class, and must be taken in the same semester as the class. Performance in the lab will be included in the overall class grade.](#)

ITCS-3145 – Parallel and Distributed Computing

Credit Hours: (3)

Parallel and distributed computing is the use of multiple processors or computers to achieve greater performance. All computers today have multiple processor cores. Topics include classification of parallel systems, programming parallel shared-memory systems, programming distributed-memory systems, patterns for parallel programming, foundation of parallel algorithms, languages and tools for parallel programming.

Pre-requisite(s): ITSC 2214 and ITSC 3181

ITCS 3190 - Cloud Computing for Data Analysis

Credit Hours: (3)

Introduction to the principles of cloud computing for data science applications. This course focuses on distributed computing, and algorithms for scalable data processing. Topics include: parallel processing, information retrieval, knowledge discovery in databases, web search, computational advertising, and scientific data analysis. Students are expected to bring their laptops to class.

Pre-requisite(s): ITSC 2214 Data Structures and Algorithms

ITCS 4124 – Advanced 3D Computer Graphics

Credit Hours: (3)

This course will introduces 3D transforms, 3D viewing and visibility algorithms; local illumination models; texture mapping; 3D surfaces; advanced lighting models; geometric modeling techniques and procedural geometry methods. (3 credit hours)

Pre-requisite(s): ITCS 3120

ITCS 4111/5111 - Introduction to Natural Language Processing

Credit Hours: (3)

The course will present practical methods and techniques of natural language processing and text mining. These techniques, mainly the techniques of syntactic and semantic processing, will be illustrated with specific tasks (such as: Information Extraction, Dialogue Systems, Information Retrieval, etc.). Most programming assignments will for the laptop. Selected ones could be done in the cloud e.g. using AlchemyAPI and/or IBM Bluemix. Students are expected to bring their laptops to each class.

Pre-requisite(s): -

ITCS 4150 – Mobile Robotics

Credit Hours: (3)

This course will introduce basic concepts and techniques used in mobile robotics. It will cover topics including mobile robot hardware, sensors and sensor data processing, planning and

control, robot architectures, localization and mapping, path planning, and mobile robot applications.

Pre-requisite(s): ITSC 2214 and MATH 2164

ITCS 4182 - Introduction to High-Performance Computing

Credit Hours: (3)

Fundamentals of parallel computer systems; throughput computing; memory hierarchies; computation/communication overlapping; mapping high level programs to low level components; leveraging accelerators; performance optimization; performance evaluation.

Pre-requisite(s): ITSC 3181, ITCS 3145, or permission of the department.

ITSC 4238 - Intelligent and Interactive System Studio

Credit Hours: (3)

This project-oriented course will introduce upper-level undergraduate students to algorithms and systems related to robotic vision, perception, navigation planning and control, mapping, localization, and human-robot interaction. Students will work in small groups to develop and implement algorithms in real mobile robots and using real sensors, which can lead to their senior design projects.

Pre-requisite(s): ITCS 3153