2012-2013 LONG SIGNATURE SHEET

Proposal Number: DSBA-08-15-13

Proposal Title: Establish Professional Science Master's in Data Science and Business Analytics

Originating Department: College of Computing & Informatics and Belk College of Business Data Science and Business Analytics Planning Committee

UNC CHARLOTTE

TYPE OF PROPOSAL: UNDERGRADUATE_____ GRADUATE __X__ UNDERGRADUATE & GRADUATE____

(Separate proposals sent to UCCC and Grad. Council)

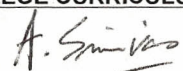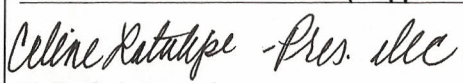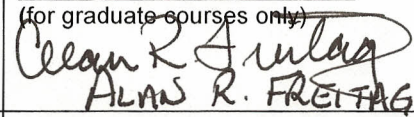| DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
8/1/13	8/28/13	8/29/13	Approved	**DEPARTMENT CHAIR** *C Saydam* Cem Saydam
9/4/13	9/11/13	9/13/13	Approved	**COLLEGE CURRICULUM COMMITTEE CHAIR** *Alan Blankley* Alan Blankley
9/16/13	10/11/2013	10/11/2013	Approved	**COLLEGE FACULTY CHAIR (if applicable)** *Rob Roy McGregor* Rob Roy McGregor
10/11/2013	10/11/2013	10/16/2013	Approved	**COLLEGE DEAN** *Steve Ott* Steve Ott
			Approved	**GENERAL EDUCATION** (if applicable; for General Education courses) [print name here:]
			Approved	**UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR** (for undergraduate courses only)
10-16-13	11-5-13	11-5-13	Approved	**GRADUATE COUNCIL CHAIR** (for graduate courses only) *Alan R Freitag* ALAN R. FREITAG
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

2012-2013 LONG SIGNATURE SHEET

UNC CHARLOTTE

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TYPE OF PROPOSAL: UNDERGRADUATE_____ **GRADUATE**__X__ **UNDERGRADUATE & GRADUATE**____
(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
9/21/2013	10/11/2013	10/11/2013	Approved	**COLLEGE CURRICULUM COMMITTEE CHAIR** *A. Srinivas.* Srinivas Akella
10/11/2013	10/15/2013	10/15/2013	Approved	**COLLEGE FACULTY CHAIR (if applicable)** *Celine Latulipe - Pres. ilec.* K. R. Subramanian
			Approved	**COLLEGE DEAN** Yi Deng
10-16-13	11-5-13	11-5-13	Approved	**GRADUATE COUNCIL CHAIR** (for graduate courses only) *Clean R Freitag* ALAN R. FREITAG
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

Revised 12/18/12
OAA/mjw

UNC CHARLOTTE

LONG FORM
COURSE AND CURRICULUM PROPOSAL

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*To: Graduate Council Chair

From: College of Computing & Informatics and Belk College of Business Data Science and Business Analytics Planning Committee

Date: August 15, 2013

Re: Establish Professional Science Master's in Data Science and Business Analytics

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The Long Form is used for major curriculum changes. Examples of major changes can include: creation of a new major, creation of a new minor, creation of a new area of concentration, or significant changes (more than 50%) to an existing program (Note: changing the name of an academic department does not automatically change the name(s) of the degree(s). The requests must be approved separately by the Board of Governors.)

Submission of this Long Form indicates review and assessment of the proposed curriculum changes at the department and collegiate level either separately or as part of ongoing assessment efforts.

*Proposals for undergraduate courses 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.

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

NEW GRADUATE PROGRAM PROPOSAL FROM THE DATA SCIENCE AND

BUSINESS ANALYTICS PLANNING COMMITTEE OF THE BELK COLLEGE OF

BUSINESS AND THE COLLEGE OF COMPUTING AND INFORMATICS

TITLE: Establish Professional Science Master's in Data Science and Business Analytics

II. CONTENT OF PROPOSALS
      A. PROPOSAL SUMMARY.
          1. SUMMARY.

          The Belk College of Business and the College of Computing and Informatics propose to add a new interdisciplinary, professional science master's degree in Data Science and Business Analytics. This master's program establishes a coherent curriculum that draws from the disparate offerings across two colleges, allowing students to gain the expertise needed to satisfy the degree requirements.

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

          The proposed Professional Science Master's Degree in Data Science and Business Analytics (DSBA) closely aligns with the UNC Charlotte mission as North Carolina's urban research university. It strongly supports the university's focus on community engagement, professional programs, and economic development for the Charlotte region and aligns with the missions of the two participating Colleges: Belk College of Business (BCOB) and College of Computing and Informatics (CCI). The joint Professional Science Master's degree program in Data Science and Business Analytics combine the strengths of both colleges and helps address the strong demand for employees with data science and business analytics training. A study by the McKinsey Global Institute (May 2011) estimates that U.S. organizations will create 290,000 to 340,000 "big data" jobs by 2018. More than half of those jobs will go unfilled with present

production of workers in this area. The proposed Professional Science Master's degree addresses this need. The program is designed to graduate students well equipped for employment in a wide variety of data intensive industries such as financial services, energy, retail/supply chain and health care, where the need for business analysts with quantitative and computational skills is growing at an explosive pace.

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

All courses proposed for the Professional Science Master's degree in Data Science and Business Analytics (DSBA) are approved or currently being taught by either the Belk College of Business or the College of Computing and Informatics. A short-form curriculum proposal establishing DSBA 6400 – Data Science and Business Analytics Practicum accompanies this proposal. Thus, there are no new prerequisites/co-requisites for these courses. The only requirement beyond current course prerequisites is entry into the Data Science and Business Analytics Professional Science Master's degree program.

The minimum admission requirements for the Professional Science Master's degree in DSBA are:

- An earned undergraduate degree in any scientific, engineering or business discipline or a closely related field;
- An undergraduate GPA of 3.0 or greater;
- Acceptable scores on the verbal, quantitative, and analytical sections of the GRE;
- Positive letters of recommendation;
- A statement of purpose outlining the goals for pursuing a graduate education;
- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet based) or a minimum IELTS band score of 6.5 is required from any applicant whose native language is not English; and
- Other credentials as required by the Graduate School.

In addition, the program requires a current working knowledge of at least one higher-level (procedural) language, and a familiarity with computer applications. The following minimal background in mathematics is also required: two semesters of calculus and one semester of statistics. Individuals who have worked at a high professional level in the computer industry or business may be able to

substitute work experience for specific subject area admission requirements. Individuals without a business degree or business experience will be required to complete an online business fundamentals course prior to enrolling in the program.

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

No new courses are proposed for this degree.

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

The Data Science and Business Analytics (DSBA) Professional Science Master's (PSM) degree will formalize the interdisciplinary collaboration between the Belk College of Business and the College of Computing and Informatics, and help prepare students for opportunities in data science and business analytics. Belk College faculty and departments will contribute business process knowledge and the application of analytics, while the College of Computing and Informatics faculty and departments will offer expertise in informatics, analytics, security, knowledge discovery, and complex modeling. Quality, scope and efficiencies are realized by combining the skills and resources of these two colleges and faculty.

The joint academic program in Data Science and Business Analytics combine the strengths of both colleges and enhance joint engagement in the larger business community through efforts such as the Data Science and Business Analytics Initiative and the Charlotte Informatics Conference, which involve all the major companies in the region as well as several entrepreneurial start-ups. In addition, a main objective of the DSBA PSM is to engage students in educational and research activities that focus on real-world challenges, as well as to satisfy company needs in specific industries.

The DSBA PSM will enhance the current portfolio of masters' programs and provide synergy with other analytics, data science and informatics-related programs currently being offered.

The Charlotte region and state face a shortage of talent as the demand for data scientists and data savvy business leaders expands. The proposed DSBA PSM offers to broaden and deepen North Carolina's data science and business analytics talent pool and through the DSBA

Initiative support high-end job creation and business investment in the Charlotte region and the state.

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.

The DSBA PSM will cater to graduate students interested in an advanced interdisciplinary degree that provides an understanding of business theory and practice as well as deep informatics and analytics capabilities. Students entering the program will have completed an undergraduate degree in economics, business, healthcare computer science, information technology or a quantitative discipline such as mathematics, statistics or engineering, with at least one object-oriented programming course. This specific requirement can be met by courses at UNC Charlotte, or equivalent courses at other institutions, or work experience.

Admission requirements for the DSBA PSM will be competitive. Students will have to enter with at least a 3.0 undergraduate grade point average (out of a 4.0 scale). Students must also score satisfactorily on the GRE or GMAT. Students from non-English speaking countries will have to demonstrate proficiency in English through acceptable scores on the TOEFL or IELTS exams.

2. What effect will this proposal have on existing courses and curricula?
   a. When and how often will added course(s) be taught?

   No new courses are proposed.

   b. How will the content and/or frequency of offering of other courses be affected?

Each of the courses required for the DSBA PSM will be offered at least once a year for DSBA PSM students. There will be no changes in course content.

c. What is the anticipated enrollment in course(s) added (for credit and auditors)?

No new courses are added in this proposal.

d. How will enrollment in other courses be affected? How did you determine this?

Enrollment in the courses are expected to increase about 20 students per section for the core courses in the first two years. Enrollment increases in the elective courses will be less. An extensive survey was conducted among undergraduate students and alumni from the Belk College of Business and the College of Computing and Informatics to evaluate the interest and likely demand for the proposed PSM in Data Science and Business Analytics. Based on the data collected there is a considerable potential interest in the program, suggesting that the size of the program will be determined by availability of resources rather than demand. Presently there are enough projected seats available in most of the core courses, but a section may need to be added to MBAD 6201, ITCS 6160 and ITCS 5122. BCOB and CCI are prepared to do that. As enrollment in the DSBA increases in the subsequent years, additional sections will be offered for other courses.

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.)

No changes in catalog copy of other departments or colleges.

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).

The current faculty at the University has the expertise needed to teach the courses in the proposed program. Many of the courses in the proposed

program are or will be shared with the existing degree programs in the BCOB and CCI. Such sharing will create synergy between the proposed program and existing programs, and also between the two colleges involved. Such synergy, we believe, will help to strengthen the existing programs. Although there currently are enough faculty to cover courses in the program, many of the core courses are approaching capacity. Therefore, we may need to hire new faculty to teach additional sections of those courses. We expect to hire four new faculty members in the first four years of the program to cover additional sections as well as increased demand for these courses from existing degree programs. One of the new faculty positions will be an endowed chair in Consumer Analytics, funded by the Belk, Inc. endowment and augmented by state matching funds.

Table 1: Qualified Faculty Members Interested in Teaching in the DSBA PSM

Faculty Name	Title	Affiliation
Dr. Srinivas Akella	Associate Professor	CS
Dr. Jianping Fan	Professor	CS
Dr. Zbigniew Ras	Professor	CS
Dr. William Ribarsky	Professor & Chair & Bank of America Endowed Chair in Information Technology	CS
Dr. Richard Souvenir	Associate Professor	CS
Dr. Xiaoyu Wang	Research Assistant Professor	CS
Dr. Wensheng Wu	Assistant Professor	CS
Dr. Jing Yang	Associate Professor	CS
Dr. Mirsad Hadzikadic	Professor & Director of Complex Systems Institute	SIS
Dr. Anita Raja	Associate Professor	SIS
Dr. David Wilson	Associate Professor	SIS
Dr. Xintao Wu	Professor	SIS
Dr. Cem Saydam	Professor & Chair	BISOM
Dr. Ram Kumar	Professor	BISOM
Dr. Chandra Subramaniam	Associate Professor	BISOM
Dr. Kexin Zhao	Assistant Professor	BISOM
Dr. Xiuli He	Assistant Professor	BISOM
Dr. Monica Johar	Associate Professor	BISOM
Dr. Antonis Stylianou	Professor	BISOM
Dr. Sunil Erevelles	Associate Professor & Chair	Marketing
Dr. Christie Amato	Professor & Associate Dean for Graduate Programs	Marketing

Dr. Sangkil Moon	Associate Professor	Marketing
Dr. Jennifer Ames-Stuart	Assistant Professor	Marketing
Dr. Charles Bodkin	Professor	Marketing
Dr. Jared Hansen	Assistant Professor	Marketing
Dr. Jennifer Troyer	Professor & Chair	Economics
Dr. Rob Roy McGregor	Professor	Economics
Dr. Craig Depken	Professor	Economics
Dr. Steve Billings	Assistant Professor	Economics

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

The program will use facilities on the UNC Charlotte main campus and the UNC Charlotte Center City Campus. These facilities should be sufficient for the program. No unusual requirement is anticipated. Master classrooms will be suitable for these courses.

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

No special equipment or supplies will be needed to offer the DSBA PSM program. Future equipment upgrades will be funded through a Campus Based Tuition Increment.

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 by available for the course(s).

Since no new courses are being added, adequate computer resources are currently available to offer the DSBA PSM program. Current facilities are described below:

Available Laboratories and Facilities for the Proposed DSBA Master's Program	
College of Computing and Informatics	
Name	**Description**
Teaching Laboratories:	
CCI General Purpose Computer Lab	PC Windows lab for all CCI students. WH 120, 1522 sq. ft.
CCI Open Student Lab	Mac, Linux lab for all students. WH 143, 297 sq. ft.
Introduction to Computer Science Lab	Hands-on teaching lab for introduction to computer science courses,

	Cone 164, 604 sq. ft.
Computer Teaching Labs	A teaching lab equipped with Apple Mac desktops for teaching and class projects, in the new Bioinformatics Building. Over 3000 sq. ft.
Cyber Corps Lab	Computer security laboratory, 400 sq. ft. WH 305B, 400 sq. ft.
Relevant Research Labs will be made available for teaching purpose as needed:	
Computer Science Networking Research Lab	The Networking Research Lab conducts research in the areas of Mobile Network Architectures and Protocols; ?Mobile Computing (models, algorithms, and middleware)?Survivable Networks; ?Wilress Ad hoc and Sensor Networks; Three-Dimensional Networks ?Design, Visualization, Simulation, and Modeling of Network Protocols; and?Network Security. For more information: http://nrl.uncc.edu/ WH 402, 653 sq. ft.; moving to WH 203,231, 976 sq. ft.
Visualization laboratory	The Charlotte Visualization Center strives to develop and promote the science of visual analytics and to advance interactive visualization as an integrative discipline that is indispensable for attacking key real world applications. The Center is one of five regional centers across the United States that is supported by the Department of Homeland Security and National Visualization and Analytics Center. The VisCenter is also a formal partner in conjunction with two of the Department of Homeland Security's Centers of Excellence. For more information: http://www.viscenter.uncc.edu/ WH 412/437, 1987 sq. ft.
Computer Science Biomedical Research and Instruction Lab	WH 431, 432A, 521.49 sq. ft.
Information and Infrastructure Security Lab	The mission of the Laboratory of Information Integration, Security, and Privacy (LIISP) is to add value to the university, community, and society through innovative educational programs, research and development in the areas of information integration, security, and privacy. We aim to be one of the leading academic institution for research in

	information integration, security, and privacy and provide innovative education and training programs in information integration, security, and privacy. For more information: http://liisp.uncc.edu/ WH 331, 331A, 988 sq. ft.
Vulnerability Assessment Lab	WH 302, 622 sq. ft.
Cyber Defense and Network Assurance Lab	The Cyber Defense and Network Assurability (CyberDNA) Center offers high-impact quality research and education in the area of network security, defense, assurability, and privacy. Specific domains of interest include: assurable and usable network security configuration, security automation, security evaluation and optimization, security policy synthesis, and problem/threat diagnosis. In addition, CyberDNA seeks novel scalable authentication, accountability and privacy techniques for emerging technologies as well as critical infrastructure networks. The CyberDNA offers an excellent educational environment through conferences, seminars, mentoring, and security labs and test beds, which attracts many graduate and undergraduate students to pursue rigorous research. For more information: http://www.cyberDNA.uncc.edu WH 305A, 280 sq. ft.
Honey Net Research Lab	The UNC Charlotte Honeynet project is part of the research effort of the network security group in the Laboratory of Information and Infrastructure Security. We hope to use the honeynet to gather important data as input to network and security research. This data can then be used as an educational tool to increase the knowledge of all network security students and professionals. Our honeynet implementation uses an ISP and is not part of the campus network. WH 307, 149 sq. ft.
Computer Forensics Lab	WH 334 281 sq. ft.
Human-Computer Interaction Lab	The Human Computer Interaction Lab investigates novel ways for people to interact with computers, and through computers with their environments. Our research covers a

	broad range of areas related to Human Computer Interaction, such as Novel Interaction and Multimedia, Computer Supported Cooperative Work, and Privacy. We collaborate with researchers in a number of areas related to HCI, such as visualization, virtual reality, gaming, and technical communications. For more information: http://hci.sis.uncc.edu/ WH 300, 616 sq. ft.

Belk College of Business

Name	Description
Teaching Laboratories:	
Instructional Lab	Friday 339 = 40-seat Windows based computer lab equipped with campus-standard and discipline-specific software, 1334 sq. ft.
Instructional Lab	Friday 280 = 32-seat Windows based computer lab equipped with campus-standard and discipline-specific software, 1274 sq. ft.
Open Student-Use Lab	Friday 338 = 42-seat Windows based computer lab equipped with campus-standard and discipline-specific software, 1226 sq. ft.
Open Student-Use Lab	Friday 216 = 30-seat Windows based computer lab equipped with campus-standard and discipline-specific software. 934 sq. ft.
Specialty Laboratory:	
Trading Room	Friday 391 = 5-seat Windows 7 computer lab equipped with campus-standard and discipline-specific software, 1 Bloomberg Terminal which users can monitor and analyze real-time financial market data and place trades on the electronic trading platform, and 1 Live Stock Ticker, 793 sq. ft.

UNC Charlotte Center City Building

Name	Description
Teaching Laboratories:	
Instructional Lab	CCB 801 = 62-seat dual-boot Mac OS 10.7/Windows 7 computer lab equipped with campus-standard and discipline-specific software. 1596, sq. ft.
Instructional Lab	CCB 802 = 57-seat dual-boot Mac OS 10.7/Windows 7 computer lab equipped with

	campus-standard and discipline-specific software, 1591 sq. ft.

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

        No new resources will be requires.

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

        No other resources are required to deliver this program.

     G. **SOURCE OF FUNDING**. Indicate source(s) of funding for new/additional resources required to support this proposal.
As mentioned above, one of the new faculty positions will be an endowed chair in Consumer Analytics funded by the Belk, Inc. endowment plus state matching funds. The three other faculty positions will come from enrollment increase funds as well as current University funds. Support for the program will also come from a Campus Based Tuition Increment.

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 appendix A

     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).

        None needed. Since both colleges have put forward this proposal, no additional consultation was determined to be necessary.

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.

The proposal was unanimously approved by the College of Computing and Informatics and Belk College of Business Data Science and Business Analytics Planning Committee on ____8-15-13_____

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.

No new courses are proposed for this program.

C. **ATTACHMENTS**.
1. CONSULTATION: Attach relevant documentation of consultations with other units.
None needed. Since both colleges have put forward this proposal, no additional consultation was determined to be necessary.

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.

No new courses are proposed for this program.

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.

No new courses are proposed for this program.
See Appendix C for Proposed Catalog Copy for the Program.

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.

Request to Plan (Appendix A) approval received from General Administration on May 1, 2013. Request to Establish (Appendix C) is provided as an addendum to this proposal.

4. ACADEMIC PLAN OF STUDY (UNDERGRADUATE ONLY): Please indicate whether the proposed change will impact an existing Academic Plan of Study and require changes to CAPP. If so, provide an updated Academic Plan of Study in template format (Academic Plan of Study templates can be found online at provost.uncc.edu/resources-and-reports).

5. STUDENT LEARNING OUTCOMES: Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

A Student Learning Outcomes Assessment Plan for the DSBA PSM program is included in Appendix B.

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?

No new courses are proposed for this program.

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.

APPENDIX A

Library consultation

Consultation on Library Holdings

To: Dr. Cem Saydam
From: Nicole Spoor
Date: August 13, 2013

Subject: Establishment of Data Science and Business Analytics Professional Science Master's Degree

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Summary of Librarian's Evaluation of Holdings:

Evaluator: Nicole Spoor, Business Librarian   **Date:** August 13, 2013
Please Check One:
   1. Holdings are superior   ☐
   2. Holdings are adequate   ☒
   3. Holdings are adequate only if dept. purchases additional items   ☐
   4. Holdings are inadequate   ☐

Comments:
After a thorough evaluation of Atkins Library resources with regards to journals, databases, and circulating books that are relevant to the establishment of a Professional Science Master's degree in Data Science and Business Analytics, it is found that the library's resources are sufficient to support this program.
The following table shows the print source holdings that are relevant to a Professional Science Master's degree in Data Science and Business Analytics. After performing multiple searches of the catalog, it is found that there are adequate resources related to Data Science and Business Analytics. Individual books not owned by the library may be requested through the library's interlibrary loan service.

Catalog Searches Performed	Total Results	Results Less Than 5 Years Old
Data AND Business	2524	339
Big Data	14	13
Business Analytics	55	36
Innovation AND (Business OR	1348	487

Industry)		
"Business Intelligence"	272	81
"Supply Chain"	501	129
Econometrics	525	35

Print sources will not be the most relevant resource for this certificate. Databases containing current research will prove more useful for students. The following is a list of selected databases that may be relevant to Data Science and Business Analytics to which Atkins Library provides access:

Business Source Complete
EconLit
IEEE Xplore
INSPEC
JSTOR
Lexis Nexis Academic
ScienceDirect
SimplyMap

Atkins Library also has access to several journal titles that may be relevant to Data Science and Business Analytics. Journal articles not owned by the library may be requested through the library's interlibrary loan service.

Business Intelligence Journal
Business Intelligence Review
Data and Knowledge Engineering
Journal of Data Management
Innovation: The Magazine of Research & Technology
Innovation: Management, Policy and Practice

Conclusion:
The holdings of Atkins Library with regards to print resources, databases and journals are sufficient to support the establishment of a Professional Science Master's degree in Data Science and Business Analytics. It is suggested that the participating academic departments continue ordering new resources as they are published.

Evaluator's Signature: Nicole Spoor, Business Librarian, Atkins Library

Date: August 13, 2013

APPENDIX B

Assessment Plan

UNC CHARLOTTE

Student Learning Outcomes Assessment Plan

College: Graduate School, Belk College of Business, and College of Computing and Informatics
Department: Interdisciplinary
Degree Program: Data Science and Business Analytics Professional Science Master's

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

Students will demonstrate knowledge of big data 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.

The instrument used to assess student mastery of this learning outcome will include questions embedded in course exams. Specifically, the questions will gauge students' mastery of the following effectiveness measures:
1. Students will demonstrate knowledge of the strategic use of big data business theory and practice.
2. Students will demonstrate knowledge of information technology and computational analytics.
3. Students will demonstrate knowledge of statistical modeling and analysis.

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 SLO will be measured in DSBA 6100, Big Data Analytics for Competitive Advantage, every other Spring semester.

Student performance for each of the effectiveness measures will be assessed using questions embedded in course exams. Students that answer 80% of the questions associated with each effectiveness measure correctly will be deemed to have satisfied learning related to that effectiveness measure.

Program faculty members are responsible for collecting assessment data. Program faculty report(s) individual student assessment results to the Belk College of Business Assurance of Learning [AoL] Data Center. The Data Center collects and combines the program's assessment data from across multiple courses and sections. The Data Center then aggregates the data and returns statistical results to all program faculty. Program faculty members analyze these results and hold a closing the loop meeting following the semester in which assessment was conducted to complete the continuous improvement process. At this meeting, program faculty determine what changes or improvements should be made to

instruction, the program, individual courses, or to the assessment process. Changes are implemented the next time the course is taught.

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*

With respect to each of the effectiveness measures,
1. 80% of students assessed will answer 80% of the exam questions correctly related to the strategic use of big data business theory and practice.
2. 80% of students assessed will answer 80% of the exam questions correctly related to information technology and computational analytics.
3. 80% of students assessed will answer 80% of the exam questions correctly related to statistical modeling and analysis.

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

Students will demonstrate the ability to think critically in making decisions based on data and 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. <u>A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.</u>

The instrument used to assess student mastery of this learning outcome will include questions embedded in an internship or practicum evaluation. Specifically, the questions will gauge students' mastery of the following effectiveness measures:
1. Students will demonstrate the ability to identify, analyze, and evaluate alternative solutions to problems.
2. Students will demonstrate the ability to demonstrate knowledge of skills needed to craft and implement strategic and tactical plans.
3. Students will demonstrate the ability to defend their analysis.

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 SLO will be measured in DSBA 6400, DSBA Internship, every other Spring semester.

Student performance for each of the effectiveness measures will be assessed using questions embedded in an internship or practicum evaluation. The questions will be scored using a five point rubric, where a score of a 1 is "inadequate" and a score of a 5 is "exceeds expectations". Students that earn a 4 (meets expectations) or 5 (exceeds expectations) will be deemed to have satisfied learning related to that effectiveness measure.

Program faculty members are responsible for collecting assessment data. Program faculty report(s) individual student assessment results to the Belk College of Business Assurance of Learning [AoL] Data Center. The Data Center collects and combines the program's assessment data from across multiple courses and sections. The Data Center then aggregates the data and returns statistical results to all program faculty. Program faculty members analyze these results and hold a closing the loop meeting following the semester in which assessment was conducted to complete the continuous improvement process. At this meeting, program faculty determine what changes or improvements should be made to instruction, the program, individual courses, or to the assessment process. Changes are implemented the next time the course is taught.

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.*

With respect to each of the effectiveness measures,
1. 80% of students assessed will earn a '4' or '5' on questions related to identifying, analyzing, and evaluating alternative solutions to problems.
2. 80% of students assessed will earn a '4' or '5' on questions related to skills needed to craft and implement strategic and tactical plans.
3. 80% of students assessed will earn a '4' or '5' on questions related to defending an analysis.

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

Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

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. <u>A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.</u>

The instrument used to assess student mastery of this learning outcome will include questions embedded in an internship or practicum evaluation. Specifically, the questions will gauge students' mastery of the following effectiveness measures:
1. Students will demonstrate the ability to use techniques to analyze facts to predict trends.
2. Students will demonstrate the ability to use transactional data to identify risks and opportunities.
3. Students will demonstrate knowledge of how predictive and prescriptive modeling supports business decision-making.

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 SLO will be measured in DSBA 6400, DSBA Internship, every other Spring semester.

Student performance for each of the effectiveness measures will be assessed using questions embedded in

an internship or practicum evaluation. The questions will be scored using a five point rubric, where a score of a 1 is "inadequate" and a score of a 5 is "exceeds expectations". Students that earn a 4 (meets expectations) or 5 (exceeds expectations) will be deemed to have satisfied learning related to that effectiveness measure.

Program faculty members are responsible for collecting assessment data. Program faculty report(s) individual student assessment results to the Belk College of Business Assurance of Learning [AoL] Data Center. The Data Center collects and combines the program's assessment data from across multiple courses and sections. The Data Center then aggregates the data and returns statistical results to all program faculty. Program faculty members analyze these results and hold a closing the loop meeting following the semester in which assessment was conducted to complete the continuous improvement process. At this meeting, program faculty determine what changes or improvements should be made to instruction, the program, individual courses, or to the assessment process. Changes are implemented the next time the course is taught.

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*

With respect to each of the effectiveness measures,
1. 80% of students assessed will earn a '4' or '5' on questions related to using techniques to analyze facts and predict trends.
2. 80% of students assessed will earn a '4' or '5' on questions related to using transactional data to identify risks and opportunities.
3. 80% of students assessed will earn a '4' or '5' on questions related to how predictive and prescriptive modeling supports business decision-making.

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

Students will demonstrate the ability to translate data into clear actionable items.

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.

The instrument used to assess student mastery of this learning outcome will include questions embedded in an internship or practicum evaluation. Specifically, the questions will gauge students' mastery of the following effectiveness measures:
1. Students will demonstrate the ability to acquire data.
2. Students will demonstrate the ability to clean data.
3. Students will demonstrate the ability to transform data into actionable insights.

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 SLO will be measured in DSBA 6400, DSBA Internship, every other Spring semester.

Student performance for each of the effectiveness measures will be assessed using questions embedded in an internship or practicum evaluation. The questions will be scored using a five point rubric, where a score of a 1 is "inadequate" and a score of a 5 is "exceeds expectations". Students that earn a 4 (meets expectations) or 5 (exceeds expectations) will be deemed to have satisfied learning related to that effectiveness measure.

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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*

With respect to each of the effectiveness measures,
1. 80% of students assessed will earn a '4' or '5' on questions related to acquiring data.
2. 80% of students assessed will earn a '4' or '5' on questions related to cleaning data.
3. 80% of students assessed will earn a '4' or '5' on questions related to transforming data into actionable insights.

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

Students will demonstrate effective communication skills that facilitate the effective presentation of analysis results.

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. <u>A copy of the data collection instrument and all scoring rubrics associated with this student learning outcome are to be attached to the plan.</u>

The instrument used to assess student mastery of this learning outcome will include questions embedded in an internship or practicum evaluation. Specifically, the questions will gauge students' mastery of the following effectiveness measures:
1. Students will demonstrate the ability to communicate clearly in writing.
2. Students will demonstrate the ability to orally present analysis results to classmates, faculty, and interested business community members.
3. Students will demonstrate the ability to work as an effective team player.

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 SLO will be measured in DSBA 6400, DSBA Internship, every other Spring semester.

Student performance for each of the effectiveness measures will be assessed using questions embedded in an internship or practicum evaluation. The questions will be scored using a five point rubric, where a score of a 1 is "inadequate" and a score of a 5 is "exceeds expectations". Students that earn a 4 (meets expectations) or 5 (exceeds expectations) will be deemed to have satisfied learning related to that effectiveness measure.

Program faculty members are responsible for collecting assessment data. Program faculty report(s) individual student assessment results to the Belk College of Business Assurance of Learning [AoL] Data Center. The Data Center collects and combines the program's assessment data from across multiple courses and sections. The Data Center then aggregates the data and returns statistical results to all program faculty. Program faculty members analyze these results and hold a closing the loop meeting following the semester in which assessment was conducted to complete the continuous improvement process. At this meeting, program faculty determine what changes or improvements should be made to instruction, the program, individual courses, or to the assessment process. Changes are implemented the next time the course is taught.

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*

With respect to each of the effectiveness measures,
1. 80% of students assessed will earn a '4' or '5' on questions related to communicating clearly in writing.
2. 80% of students assessed will earn a '4' or '5' on questions related to orally presenting analysis results.
3. 80% of students assessed will earn a '4' or '5' on questions related to working as an effective team player.

Proposed Catalog Copy

Data Science and Business Analytics

- **M.S. in Data Science and Business Analytics**
- **Graduate Certificate in Data Science and Business Analytics**

Professional Science Master's Degree in Data Science and Business Analytics

dsba.uncc.edu

Graduate Certificate in Data Science and Business Analytics

dsba.uncc.edu

The program in Data Science and Business Analytics is a joint venture between the Belk College of Business, College of Computing and Informatics and the Graduate School. The program offers both a Certificate and a Master of Science degree designed to prepare students for the complex and rapidly changing data science and business analytics environment.

Faculty Director

Dr. Mirsad Hadzikadic

343-A Woodward Hall

Belk College of Business

belkcollege.uncc.edu

College of Computing and Informatics

cci.uncc.edu

Graduate School

graduateschool.uncc.edu

Deans

Dr. Steven Ott, Belk College of Business

Dr. Yi Deng, College of Computing and Informatics

Dr. Tom Reynolds, Graduate School

M.S. in Data Science and Business Analytics

The Professional Science Master's (PSM) program in Data Science and Business Analytics (DSBA) is an interdisciplinary program at the intersection of business, computer and information sciences, statistics and operations research. The program is a unique blend of business acumen, data understanding, exposure to a diverse set of advanced analytics methods, and hands-on experience designed to help students apply learned knowledge on representative business problems. DSBA graduates will be well equipped for employment in a wide variety of data intensive industries, such as financial services, energy, retail/supply chain, or health care, where the need for business analysts with quantitative, computational, and sophisticated analytical skills is growing at an explosive pace.

Admission Requirements

Applicants must meet the general Graduate School requirements for admission to Master's Degree programs. Applications must include all of the materials listed by the Graduate School as typical for Master's Degree application submissions. In addition to the general requirements for admission to the Graduate School, the following are the minimum admissions requirements for study toward the M.S. in Data Science and Business Analytics:

- An earned undergraduate degree in any scientific, engineering or business discipline or a closely related field;
- An undergraduate GPA of 3.0 or better;
- Acceptable scores on the verbal, quantitative, and analytical sections of the GRE;
- Positive letters of recommendation;
- A statement of purpose outlining the goals for pursuing a graduate education
- A minimum TOEFL score of 220 (computer-based), 557 (paper-based), or 83 (internet based) or a minimum IELTS band score of 6.5 is required from any applicant whose native language is not English.

In addition, the program requires a current working knowledge of at least one higher-level (procedural) language; and a familiarity with computer applications. The following minimal

background in mathematics is also required: two semesters of calculus and one semester of statistics. Individuals who have worked at a high professional level in the computer industry or business may be able to substitute work experience for specific subject area admission requirements. Individuals without a business degree or business experience will be required to complete an online business fundamentals course prior to enrolling in the program.

Degree Requirements

Thirty-three graduate credit hours are required for the DSBA PSM. Of the 33 graduate credit hours, 24 credit hours are required core courses inclusive of 3 hours for the internship, and 9 credit hours of electives. A minimum of 24 credit hours contributing to the M.S. in Data Science and Business Analytics must be from courses numbered 6000 or higher. A maximum of 6 hours of graduate credit may be transferred. Students may apply all of the credits earned in the Graduate Certificate in Data Science and Business analytics toward the M.S. in Data Science and Business Analytics with the approval of the DSBA program director. All students will take the following courses:

Core Requirements

DSBA 6100 Big Data Analytics for Competitive Advantage
ITCS 6160 Database Systems
MBAD 6201 Business Intelligence and Analytics
ITCS 5122 Visual Analytics
ITCS 6156 Machine Learning
MBAD 6211 Advanced Business Analytics
MBAD 6276 Consumer Analytics
DSBA 6400 DSBA Internship

Elective Courses

In addition students will choose 3 elective courses from a growing list of data science and business analytics courses or propose a three-course specialization for approval by the DSBA program director. In choosing their electives (3 courses) students must select at least one course from each of the following areas:

Data Science Electives:
ITIS 5510 Web Mining
ITCS 5121 Information Visualization
ITCS 6155 Knowledge Based Systems
ITIS 6500 Complex Adaptive Systems
ITIS 6520 Network Science

ITCS 6190 Cloud Computing for Data Analysis

Business Analytics Electives:
MBAD 6122 Decision Modeling and Analysis via Spreadsheets
MBAD 6208 Supply Chain Management
MBAD 6207 Project Management
MBAD 6277 Social Media Marketing and Analytics
MBAD 6278 Innovation Analytics
ECON 6112 Graduate Econometrics

Student-Structured Electives Option:
Students may propose a three-course specialization (9 credit hours) in a significant area of interest for approval by the Director of the PSM DSBA Program. In addition to the courses listed in the Data Science and Business Analytics specializations listed above, this specialization may include graduate courses from MS in CS, MS in IT, MBA, MS in Applied Statistics, MS in Mathematical Finance, MS in Economics, and other programs or Departments within the University with approval of the related Department.

Graduate Certificate Program in Data Science and Business Analytics

The purpose of the Graduate Certificate in Data Science and Business Analytics is to provide post-baccalaureate students with the opportunity to reach a demonstrated level of competence in the area of data science and business analytics. The certificate requires fifteen (15) graduate credit-hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

Admission Requirements

The certificate in DSBA is open to all students who hold a B.S. or M.S. degree in any scientific, engineering or business discipline and either

- are enrolled and in good standing in a graduate degree program at UNC Charlotte or
- complete their undergraduate degree with a minimum 3.0 GPA.

In addition, the program requires a current working knowledge of at least one higher-level (procedural) language; and a familiarity with computer applications. The following minimal background in mathematics is also required: two semesters of calculus and one semester of statistics. Individuals who have worked at a high professional level in the computer industry or business may be able to substitute work experience for specific subject area admission requirements. Individuals without a business degree or business experience will be required to complete an online business fundamentals course prior to enrolling in the program.

Transfer credit from another institution will not be accepted into this proposed certificate program.

Students pursuing the MS in Computer Science, MS in Information Technology and MBA degrees will have priority on space in the corresponding CS, SIS and MBA classes should demand for the proposed certificate exceed expectations.

Program Requirements
The certificate will be awarded upon completion of five graduate level courses (15 credits) in the area of data science and business analytics. A cumulative GPA of 3.0 will be required and at most one course with a grade of C may be allowed towards the certificate.

Students must take five courses, as outlined below, to receive the Graduate Certificate in Data Science and Business Analytics:

Core requirements:
DSBA 6100 Big Data Analytics for Competitive Advantage (3)
ITCS 6160 Data Base Systems (3)
MBAD 6201 Business Intelligence and Analytics (3)

One of the following courses:
ITCS 5122 Visual Analytics (3)
IT IS 6520 Network Science (3)

One of the following courses:
MBAD 6122 Decision Modeling and Analysis (3)
MBAD 6211 Advanced Business Analytics (3)
MBAD 6276 Consumer Analytics (3)

Courses in Data Science and Business Analytics

DSBA 6100. Big Data Analytics for Competitive Advantage. (3) This course provides an introduction to the use of big data as a strategic resource. A focus is placed on integrating the knowledge of analytics tools with an understanding of how companies leverage data analytics to gain strategic advantage. A case approach will be used to emphasize hands-on learning and real-world view of big data analytics. (Fall, On Demand).

ITCS 6160. Database Systems. (3) Cross-listed as HCIP 6160. Prerequisite: Full graduate standing in Computer Science or consent of the department. This course covers modeling, programming, and implementation of database systems. It focuses on relational database systems but may also address non-relational databases or other advanced topics. Major topics are (1) modeling: conceptual data modeling, ER diagram, relational data model, schema design and refinement; (2) programming: relational algebra & calculus, SQL, constraints, triggers, views; (3) implementation: data storage, indexing, query execution, query optimization, and transaction

management; and (4) advanced: semi-structured data model, XML, and other emerging topics. (Fall, Spring)

ITCS 5122. Visual Analytics. (3) Prerequisites: Graduate Standing and undergraduate course in statistics, or permission of the instructor. This course introduces the new field of visual analytics, which integrates interactive analytical methods and visualization.. Topics include: critical thinking, visual reasoning, perception/cognition, statistical and other analysis techniques, principles of interaction, and applications. (Fall)

ITCS 6156. Machine Learning. (3) Prerequisite: ITCS 6150 or permission of the instructor. Machine learning methods and techniques including: acquisition of declarative knowledge; organization of knowledge into new, more effective representations; development of new skills through instruction and practice; and discovery of new facts and theories through observation and experimentation. (Fall, Odd years)

MBAD 6201. Business Intelligence and Analytics (3) Prerequisite: MBAD 5121 or equivalent. An overview of the business approach to identifying, modeling, retrieving, sharing, and evaluating an enterprise's data and knowledge assets. Focus is on the understanding of data and knowledge management, data warehousing, data mining (including rule-based systems, decision trees, neural networks, etc.) and other business intelligence concepts. Covers the organizational, technological and management perspectives. (Fall, On demand)

MBAD 6211 Advanced Business Analytics (3) Pre-requisite: MBAD 6201 or ITCS 6162 or consent of the department. An in-depth study of applications of data analytics techniques to discover non-trivial relationships that are useful and actionable to decision makers. A case approach will be used to emphasize hands-on learning and real-world deployment of business analytics. (Spring, On Demand)

MBAD 6276. Consumer Analytics. (3) Prerequisite: MBAD 6270 or permission of the department. The utilization of analytics techniques in marketing decision-making and consumer strategy. This involves the extraction of hidden insight about consumers from structured and unstructured Big Data, and the translation of that insight into a market advantage. Applications in areas such as consumer targeting, product innovation and promotion strategy (Fall)

DSBA 6400. Internship. (3) Prerequisite: Completion of 21 credit hours of core course requirements. A data science or business analytics project is chosen and completed under the guidance of an industry partner. Each student's internship project program must be approved by the program director. A proposal form must be completed and approved prior to registration and the commencement of the internship. A mid-term report and a final report to be evaluated by the industry partner and supervising faculty. Grading will be by the supervising faculty in consultation with off-campus supervisor at the internship organization. Graded on a Pass/No Credit basis. (Fall, Spring, Summer)

MBAD 6277. Social Media Marketing and Analytics. (3) Prerequisite: MBAD 6270 or permission of the department.. The utilization of social media in marketing strategy and tactics. Topics include the use of social media in building brand strength and equity, as a customer acquisition tool and as a customer relationship management tool. The utilization of analytics in effective social media marketing. (Summer)

MBAD 6278. Innovation Analytics. (3) Prerequisite: MBAD 6270 or permission of the department.. The comprehension and application of text analytics as a tool to examine unstructured qualitative information to generate innovations. Identifying the various sources of consumer insight and using them in innovation strategy. Understand how to differentiate between what consumers want versus what they say. (Spring)

MBAD 6122. Decision Modeling & Analysis via Spreadsheets. (3) Prerequisite: MBAD 5141 or equivalent. This course focuses on the role operations research/management science plays in the decision making process. Specific topics covered in this course include fundamental techniques such as linear, integer, goal and multi objective programming, queuing theory and applications, decision support via Monte Carlo simulation, decision making under uncertainty and risk, decision trees, and multi-criteria decision making. The emphasis is on models that are widely used in all industries and functional areas, including operations, supply chain management, finance, accounting, and marketing. (Spring, On Demand)

MBAD 6208. Supply Chain Management. (3) Prerequisites: MBAD 6141 or permission of the department. Supply chain management is concerned with all of the activities performed from the initial raw materials to the ultimate consumption of the finished product. From a broad perspective, the course is designed to examine the major aspects of the supply chain: the product flows; the information flows; and the relationships among supply chain participants. The course content is interdisciplinary in nature and will cover a variety of topics such as supply chain information technologies, supply chain design, strategic alliances between supply chain participants and supply chain initiatives. (Spring, On demand)

MBAD 6207. Business Project Management. (3) Project management is widely used in a variety of business environments to manage complex, non-routine, endeavors. Examples of projects include consulting and process improvement projects, advertising projects, and technology projects. This course focuses on tools, techniques and skills for business project management, with attention to both the quantitative and the qualitative aspects of project management. Major topics include project evaluation, estimation, monitoring, risk management, audit, managing global projects, outsourcing and project portfolio management. Students will also gain experience using Project Management Software. (Spring)

ECON 6112. Graduate Econometrics. (3) Prerequisites: Admission to graduate program and permission of program coordinator. Advanced study of the theory and application of statistics to economic problems. Topics include: derivation of least-squares estimators; maximum likelihood estimation; and problems of multicollinearity, heteroskedasticity, and autocorrelation. (Fall, Spring)

ITCS 6155. Knowledge Based Systems. (3) Prerequisite: ITCS 6162 or permission of the instructor. Knowledge systems; knowledge discovery; association rules; action rules, hierarchical classifiers, cascade classifiers, query languages and their semantics; cooperative and collaborative systems; ontology and metadata; flexible query answering; chase algorithms and data sanitization methods; decision support systems in medicine, automatic indexing of music. (Spring)

ITIS 5510. Web Mining. (3) Pre- or corequisites: ITIS 5160. (3) and full graduate standing, or permission of department. Topics include: measuring and modeling the Web; crawling, Web search and information retrieval; unsupervised learning, supervised learning, semi-supervised learning in Web context; social network analysis and hyperlink analysis; text parsing and knowledge representation. (Spring)

ITIS 6500. Complex Adaptive Systems. (3) Cross-listed as ITCS 8500, ITIS 6500, and ITIS 8500. Prerequisite: Permission of instructor. Complex adaptive systems (CAS) are networked (agents/part interact with their neighbors and, occasionally, distant agents), nonlinear (the whole is greater than the sum of its parts), adaptive (the system learns to change with its environment), open (new resources are being introduced into the environment), dynamic (the change is a norm), emergent (new, unplanned features of the system get introduced through the interaction of its parts/agents), and self-organizing (the parts organize themselves into a hierarchy of subsystems of various complexity). Ant colonies, networks of neurons, the immune system, the Internet, social institutions, organization of cities, and the global economy are a few examples where the behavior of the whole is much more complex than the behavior of the parts. Examples of current research efforts are provided. Topics include: Self-organization; emergent properties; learning; agents; localization affect; adaptive systems; nonlinear behavior; chaos; complexity. (On demand)

ITCS 5121. Information Visualization. (3) Prerequisite: Graduate standing or permission of the instructor. Information visualization concepts, theories, design principles, popular techniques, evaluation methods, and information visualization applications. (Spring)

ITIS 6520. Network Science. (3) Networks are all around us, including natural and man-made systems. Examples include rivers, trees, arteries, highways, brain, economy, social connections, military, energy distribution, cyber attacks, terrorist networks, epidemics, Internet, and Facebook. Network Science helps students design faster, more resilient communication networks; revise infrastructure systems such as electrical power grids, telecommunications networks, and airline routes; model market dynamics; understand synchronization in biological systems; and analyze social interactions among people. It examines the various kinds of networks (regular, random, small-world, influence, scale-free, and social) and applies network processes and behaviors to emergence, epidemics, synchrony, and risk. The course integrates concepts across computer science, biology, physics, social network analysis, economics, and marketing. In this class students will learn (a) the basic principles, concepts, and principles of networks; (b) how and why network structures and properties determine the performance and sustainability of any system; (c) how to measure and evaluate network-based systems; (d) how to utilize networks for the benefit of their organizations and society; and (e) how to utilize and

design tools for understanding, visualizing, and applying the principles of networks. (On Demand).

ITCS 6190. Cloud Computing for Data Analysis. (3) Prerequisites: ITCS 6114 or permission of department. Familiarity with Java, Unix, Data structures and Algorithms, Linear Algebra, and Probability and Statistics are expected. Students should have good programming skills and a solid mathematical background. This course will introduce the basic principles of cloud computing for data-intensive applications. It will focus on parallel computing using Google's MapReduce paradigm on Linux clusters, and algorithms for large-scale data analysis applications in web search, information retrieval, computational advertising, and business and scientific data analysis. Students will read and present research papers on these topics, and implement programming projects using Hadoop, an open source implementation of Google's MapReduce technology, and related technologies for analyzing unstructured data. (Spring, long form in process).