

## Academic Program Approval Voting Record

This document is to be appended as the last page of the proposal for any new or revised academic program to record the successive votes of approval as the proposal moves through its required review and approval steps. Consult Faculty Handbook Section 10.8 or the Faculty Senate Curriculum Committee website for information regarding Committee review and voting requirements for each action.

Curricular Action: (check appropriate boxes below)

1.  New Program     Name Change     Discontinuation     Concurrent Degree for:
2.  Undergraduate Major     Graduate Major     Undergraduate Minor     Graduate Minor  
 Undergraduate Certificate     Graduate Certificate     Other: \_\_\_\_\_
3. Name of Proposed Change: Master of Business Analytics
4. Name of Contact Person: Qing Hu    e-mail address: \_qinghu@iastate.edu\_\_\_\_\_
5. Primary College: Business\_\_\_\_\_ Secondary College: \_\_\_\_\_
6. Involved Department(s): Computer Engineering Computer Science Industrial & Manufacturing Systems Engineering, Marketing, Supply Chain & Information Systems, Statistics

### Voting record for this curricular action:

Voting Body	Votes			Date of Vote
	For	Against	Abstain	
Dept. or Program Committee				
Statistics	28	0	4	Sept. 11, 2014
Computer Science	all			May 5, 2014
IMSE	all			May 9, 2014
College Curriculum Committee				
College of Business	5	0	0	April 30, 2014
College Approval Vote				
College of Business	all			May 2, 2014
Graduate Council				
Faculty Senate Curriculum Committee	7	0		Nov. 17, 2014
Faculty Senate Academic Affairs Council	10	0	1	Nov. 18, 2014
Faculty Senate				

## **PROGRAM APPROVAL PROCESS**

### **Highlights of the Program Approval Process:**

- The Regent universities shall submit an annual program planning list to the Board Office in the spring of each year, which includes the name and educational level of proposed programs that have already undergone an initial institutional review, are currently undergoing an in-depth institutional review, and are likely to be submitted for program approval by the Board of Regents within the year.
- The Board Office and the Council of Provosts shall review the annual program planning list.
- During the year, the universities shall complete their in-depth review of the proposed programs and submit their proposals to the Board Office using a program approval format developed by the Board Office (Form A). The form incorporates the key characteristics of a proposed program critical for Board decision-making – immediate and long-term need/demand for the program, cost to implement and operate the program, link to the institution's and Board's strategic plans, and potential for unnecessary duplication.
- A review by the Iowa Coordinating Council for Post-High School Education (ICCPHSE) shall also occur prior to being submitted for Board approval. A program with unresolved concerns by the ICCPHSE should be so noted.
- The program proposals shall be reviewed in-depth by the Council of Provosts and the Board Office.
- With the recommendation for approval by the Board Office and the Council of Provosts, the program proposal shall be submitted to the Board of Regents Education and Student Affairs Committee and Board of Regents for discussion and action.
- Substantial expenditures for the proposed program or advertising/marketing of the proposed program shall not occur until after the program is approved by the Board of Regents. This means that the institutions shall not hire any new faculty, secure facilities, develop curriculum, or advertise the program until it has been approved by the Board of Regents.

**FORM A**  
**Board of Regents, State of Iowa**

**REQUEST TO IMPLEMENT A NEW BACCALAUREATE, MASTERS,  
DOCTORAL, OR FIRST PROFESSIONAL DEGREE PROGRAM  
REVISED OCTOBER 1, 2012**

THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for a Regent university to demonstrate need and demand as well as the university's ability to offer a quality program that is not unnecessarily duplicative of other similar programs offered by colleges and universities in Iowa.

**Institution:** Iowa State University

**CIP Discipline Specialty Title:** Business Analytics

**CIP Discipline Specialty Number (six digits):** 52.1399

**Level:** M

**Title of Proposed Program:** Master of Business Analytics

**Degree Abbreviation (e.g., B.S., B.A., M.A., Ph.D.):** M.B.

**Approximate date to establish degree:**    **Month**            August            **Year**    2015

**Contact person:** (name, telephone, and e-mail) Sree Nilakanta; 294-8113; nilakant@iastate.edu

**Department that will administer new program:** Supply Chain and Information Systems

**College that will administer new program:** Business

Please provide the following information (use additional pages as needed).

1.    **Describe the proposed new degree program, including the following:**
  - a.    **A brief description of the program and a statement of academic objectives**

The Master of Business Analytics is an interdepartmental program that addresses the challenges of dealing with issues of analytics and "Big Data" intelligence. The program is structured to be delivered in a blended format that attempts to combine the best elements of the two worlds: the interactive and team work environment of traditional classes, and the flexibility and unlimited geographic reach of online education. The program provides a foundation in business process analysis, predictive modeling, sentiment analysis, knowledge discovery, analytical reporting, segmentation analysis, and data visualization. There's also a focus on applied training in areas such as fraud detection, risk management, text mining and process improvement. The academic objective of this degree program is to educate business professionals and future leaders with a unique ability to analyze business-related data that exhibit high volume, variety, and velocity. Furthermore, the program develops concepts, methods, and skills to effectively visualize and communicate business intelligence and close the chasm between business managers and data scientists.

The program will comprise a cohort of participants from industry (working professionals) who will progress together. The program requires 30 credits of graduate level courses and is expected to span 21 months of cohort participation. Students will start the program with a one-week on campus initiation class and revisit campus once during the middle of the program and at the end

to complete and graduate on campus, while taking online classes during the rest of the time. The following outcomes are expected.

- Understand and apply quantitative modeling techniques, including probability, statistics, and optimization to the solution of business problems.
- Design cross-functional solutions for business problems, using standard and advanced business analytics technologies and software.
- Evaluate data management methods and technologies used for business analytics
- Develop skill in data visualization
- Develop skill in modeling and quantifying in unstructured or new environment.
- Develop team and project management skills in Big Data context
- Communicate analytical findings effectively both orally and in writing.

A variety of assessment tools, dependent on the individual course's learning outcome, will be used.

**b. A brief description of the need for the proposed program**

The digital revolution empowered by the Internet and computer networking technology in business and individual life during the last several decades have generated unimaginable amount of data, in forms of digital record stored in databases and files servers. The volume, velocity, and variety of this data have produced a new set of problems and challenges to businesses and organizations. This challenge also created unprecedented opportunities for businesses and organizations to discover, model, and serve their customers and partners in ways never imagined and in details never possible before. Businesses that are able to master this data deluge (known as Big Data in the industry) will have tremendous competitive advantage over their competition in the marketplace. For example, Amazon, Google, Facebook, and many other traditional and high-tech companies are already reaping benefits from developing and implementing innovative "Big Data" analytic solutions.

As the trend in implementing data analytic solutions grows, demand for professionals who understand and are capable of working with and exploring and exploiting Big Data – the profession of business analytics – has exploded in recent years. According to McKinsey Global Institute, by 2018 "the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of Big Data to make effective decisions."

Iowa State University has been offering undergraduate degree programs related to business analytics in multiple departments, including Statistics, Industrial and Manufacturing Systems Engineering, Supply Chain and Information Systems, and Computer Science. The Department of Supply Chain and Information Systems in the College of Business created a Business Analytics concentration in its Management Information Systems major for undergraduate students in 2012, and it has since become the most popular choice for MIS undergraduates.

However, there is a significant segment of the graduate studies in business analytics market that has not been fully explored by our university. The attached letters of support from our corporate partners show potential demand for the graduates of this program. It is important to note that ISU has well-established brand recognition in this region, and it is the sense of faculty that many of our alumni who work as business analysts or related professionals in companies across the country, but especially in the Mid-west region will enthusiastically embrace a graduate degree in business analytics.

It is also important to recognize that given the current economic landscape and innovative education delivery technology, traditional full-time on-campus graduate programs are no longer the optimal form of getting advanced education for the vast majority of the working professionals today.

**c. The relationship of the proposed new program to the institutional mission and how the program fits into the institution's and college's strategic plan**

Various agencies of the US government, including DARPA, NSF, USDA, NSA, FDA, and DOE, are investing heavily in big data initiatives. USDA Agricultural Research Service, DARPA X-data, NIH health initiative, NSF Big Data, and research collaboration in the private sector present excellent opportunities for collaborative and contract research. It is widely accepted that big data and analytics leads to creation of new science.

At the present time the College of Business (COB) offers high quality undergraduate, master and doctoral level programs, and has a number of nationally recognized research scholars and a strong research reputation in selected fields. The addition of this master's level Business Analytics program would make a significant contribution to the College's strategic goals. The COB Strategic Plan for 2010-2015 provides the College's Vision which includes to "...provide students with skills and experiences needed to succeed in a complex, technology-driven, global society." The Master of Business Analytics program would further this goal by preparing students with an advanced set of tools and training in business analytics and data science to address the challenges of today's complex business world. The Supply Chain and Information Systems department and affiliated departments of Statistics, Computer Engineering, Computer Science, and Industrial and Manufacturing Systems Engineering have the quality of faculty and facilities required to sustain an excellent collaborative master's degree program. The proposed program will contribute to the educational mission and reputation of Iowa State University. The University 2005-2010 Strategic Plan established the goal of increasing the number and elevating the overall quality of graduate and professional students. The University 2010-2015 Strategic Plan builds on this goal to "provide exceptional undergraduate, graduate, professional, and outreach programs that prepare students and citizens for leadership and success." The proposed master's degree in business analytics advances both of these strategic priorities.

**d. The relationship of the proposed new program to other existing programs at the institution; describe how the proposed program will enhance other programs at the university.**

The proposed degree program would have synergies with existing master's programs within the COB, such as the MBA and Master of Science in Information Systems (MSIS) as well as other programs such as Master of Science in Information Assurance and Master of Science in Human Computer Interaction. Students from these and related programs would benefit from the expanded set of course offerings in Information Systems, Statistics, Computer Science, etc. at the graduate level. The SCIS department currently offers six elective classes at the 500 level, which are taken primarily by MBA and MSIS students. Statistics offers several courses that focus on various data analyses and visualization. Courses in IMSE, Software Engineering, and Computer Science also address different yet related areas of analytics. These courses will be repurposed to be delivered on line. A more robust slate of electives would also serve as a recruiting tool for the Master of Business Analytics program to attract students. This will also have a positive impact on the visibility of our other graduate programs as the depth and quality of our business analytics and data science specialization would be greatly enhanced. To the extent that these benefits increase the visibility of the program, they will also enable the COB to attract high quality graduate students.

We expect the impact on the undergraduate program also to be favorable for three reasons. First, the introduction of a Master of Business Analytics degree in the College of Business will not require reduction in the number of course offerings in the undergraduate program. The department already offers a track in business analytics through two elective courses. Second, exceptional undergraduate students are able to take additional graduate level courses to fulfill their undergraduate degree requirements and are likely to benefit from these more rigorous course offerings. Finally, ISU undergraduate students interested in furthering their business analytics and data driven decision making would be able to continue their education here at ISU.

**e. The relationship of the proposed new program to existing programs at other colleges and universities in Iowa, including how the proposed program is different or has a different emphasis than the existing programs.**

Neither the University of Iowa (SUI), nor the University of Northern Iowa (UNI) has a master's program in Business Analytics at this time, though SUI is proposing a similar program but using face-to-face delivery format targeting students in eastern Iowa. Drake University also does not have a master's program in business analytics. We believe that ISU is well-positioned to deliver a higher quality product that can be completed in 21 months of study. Special features or conditions at ISU (e.g., the High Performance Computing cluster, proximity and access to client data, etc.) make the institution a desirable, unique, or appropriate place to initiate such a degree program. There is also a great potential for ISU and SUI to collaborate on this program by taking advantage of the unique features in content and delivery of each of the programs if both proposals are approved. UNI could potentially benefit from this program by leveraging the online courses offered in our program.

Iowa State University is well known for the quality of its engineering, statistics, and information technology programs and has one of the larger colleges of engineering in the nation. The College of Business (CoB) and the College of Engineering (CoE) have excellent reputations with industry for their quality of education, as demonstrated by the size of the engineering and business career fairs each fall (the largest indoor career fair with over 270 employers represented). It is expected that a typical student in this program will be a distance education student who is taking classes part-time while full-time employed. The CoE has a long tradition of offering distance education courses and has an excellent infrastructure already in place in the Engineering-LAS Online (ELO) learning unit. There are a number of successful distance masters of engineering programs such as the Systems Engineering program which has around 100 distance students active in the program every year. Recently the CoB has grown its distance education efforts, and the CoE has worked with the CoB to offer some of the CoB courses to online engineering programs.

The College of Business has close ties with many programs in the CoE and CLAS. For example, the interdisciplinary programs in Information Assurance, Human Computer Interaction, Engineering Management, represent a growing collection of collaborative programs. These strong ties provide an excellent environment for the business analytics program which inherently requires cooperation among business, liberal arts & sciences, and engineering. Another distinguishing feature of our program is the unique combination of engineering, science, and business courses. We have worked closely with these colleges to purposefully take this approach to distinguish this program from similar programs in the country. The program provides a unique opportunity to emphasize the STEM relationship among the participating units with the added attractiveness to women and underrepresented population. Additionally, the proposed program fits with the recommendations made by The Commission on the Future of Graduate Education.<sup>1</sup>

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<sup>1</sup> : "Wendler, C., Bridgeman, B., Markle, R., Cline, F.,  
dg/h/aa/newprog.doc  
11/26/2014@9:53 AM

f. **Does the proposing institution have personnel, facilities, and equipment adequate to establish and maintain a high quality program?**

A typical student for this program will be a distance education student. The CoE already has an excellent infrastructure in place to offer distance education courses including 1) distance education classrooms with the necessary technology for recording distance education courses, 2) technicians with the experience to provide professional delivery of lectures to the students, and 3) a very experienced support staff in the Engineering-LAS Online learning unit. In addition our faculty has many years of experience in delivering distance education courses. Iowa State has long been recognized for its excellent distance education program.

Several new courses are being developed and will complement a set of existing courses to build the curriculum. The University has embarked on an effort to hire a cluster of high caliber faculty to lead the effort in Big Data research and education. With the addition of the cluster of faculty and with existing faculty with expertise in the area of analytics and data science, the colleges are equipped to offer this program.

In order to ensure a high level of success the program will have a dedicated program coordinator in the College of Business. See attached curricula and program details in Appendix.

g. **How does student demand for the proposed program justify its development?**

Over thirty universities and colleges of similar or higher stature compared to ISU offer a master's degree in business analytics or related fields such as data science. These programs range from full time on campus to part time and on line. They also range in coverage from business focus to data science. As of 2012, these programs combined graduated about 1,252 enrollees. All programs are currently operating at capacity and are unable to meet the ever growing demand for more graduates. The tuition charged varies across institution, with an average of \$36,127 for the degree. A recent report by McKinsey shows an unmet demand of "1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions" in the US alone<sup>2</sup>. The cost of the proposed program at ISU will be \$15,600 for instate students and \$32,800 for outstate students based on the current ISU tuition schedule. Details of the economics of the program are listed later.

2. **Describe the state and/or national workforce need and/or demand for graduates of the proposed program currently and in the foreseeable future (provide documentation about the sources of data used to estimate need and demand).**

Gartner group predicts that nearly 85% of Fortune 500 organizations will be unable to exploit Big Data for competitive advantage because of a severe shortage of trained workforce<sup>3</sup>. They report that by 2015 there will be 4.4 million Big Data jobs created. The 2014 study by IDG stated that nearly half of their respondents are either implementing or planned to implement big data projects<sup>4</sup>.

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Bell, N., McAllister, P., and Kent, J. (2010). The Path Forward: The Future of Graduate Education in the United States. Princeton, NJ: Educational Testing Service."

<sup>2</sup> "Big Data: The next frontier for innovation, competition, and productivity," Manyika, James, M. Chui, B. Brown, J. Bughin, R. Dobbs, C. Roxburgh, and A. H. Byers, Report, McKinsey Global Institute, May 2011.

<sup>3</sup> Gartner Survey Reveals That 64 Percent of Organizations Have Invested or Plan to Invest in Big Data in 2013, press release.

<sup>4</sup> 2014 Big Data Research by IDG Enterprise, IDG research presentation

U.S. News and World Report ranked Iowa State third in the nation in job placement rates among full-time 2010 MBA Graduate Students. Specifically, 96% of job-seeking ISU MBA graduates accepted job offers within three months of graduating. Our placement rate indicates that the ISU College of Business is producing well trained, quality graduates. Though the strong job market for graduates of our MBA programs is likely to carry over to graduates of the more analytics-focused master's program, our focus for this program is to enhance the analytics and data science qualifications of current employees at firms. On the other hand, our strong record of job placement should help in recruiting of prospective students for our program. Our strategy of offering a strong technical skill set that is well suited to areas such as Big Data, marketing analytics, sentiment analysis, etc., should also distinguish graduates with the Master of Business Analytics degree from the broad-based MBA degree and other specialized masters. In order to gauge demand for this type of degree program, we also contacted many of our area employers, including Pioneer, John Deere, Union Pacific, Kingland Systems, IBM, General Dynamics, Principal Financial, and others. We outlined the proposed program and asked for their feedback on the perceived demand for such a skill set. The responses ranged from positive to enthusiastic, and contained several suggestions which have served to enhance the proposal.

Overall, we believe these responses are the best indicator of potential market demand for the proposed degree. The Education Advisory Board on Big Data says<sup>5</sup>, "The biggest barrier to realizing Big Data's potential is a nascent skill shortage." Hundreds of thousands of "data scientists" – professionals combining programming, statistics and business domain skills – will be needed in the years ahead, with millions of traditional white-collar jobs in management, sales, marketing and HR likely to require the ability to pose and interpret sophisticated data analysis. Many think continuing, professional, and online education units are ideally positioned to help their institutions respond to this opportunity, as the terrain is inherently interdisciplinary, spans undergraduate, working adult, and international student populations, and many established programs are likely to benefit from Big Data curriculum concentrations or extensions.

3. **List all other public and private institutions of higher education in Iowa currently operating programs similar to the proposed new degree program. (For comparison purposes, use a broad definitional framework, e.g., such identification should not be limited to programs with the same title, the same degree designation, having the same curriculum emphasis, or purporting to meet exactly the same needs as the proposed program.)**

There are no other blended Master of Business Analytics programs at other Iowa institutions. The University of Iowa is proposing an on campus program catering to full time students.

If the same or similar program exists at another public or private institution of higher education in Iowa, respond to the following questions:

- a. Could the other institution reasonably accommodate the need for the new program through expansion? Through collaboration?

At this time, none of the Regent's three institutions has a Master of Business Analytics program. With both ISU and SUI proposing a similar degree program, with differentiating target student population and delivery methods, there is a great potential to collaborate if both proposals are approved. The proposed ISU program focuses on working professionals nationally and reaching them via synchronous and asynchronous modes of delivery using a blended format, while the SUI program focusing on students in

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<sup>5</sup> Opportunities for Continuing and Professional Education in the Next Decade, Industry Insights – Big Data, Education Advisory Board, March 2013.

eastern Iowa with face-to-face instruction. There are possibilities for articulation of courses between the two programs.

- b. With what representatives of these programs has there been consultation in developing the program proposal? Provide a summary of the response of each institution consulted.

We contacted the business college associate deans in June 2014 at SUI and UNI for support. SUI declined to provide a support letter citing that they were considering a similar program. We have not received any response to our request from UNI. but will reach out again for potential collaboration with UNI if the proposal is approved.

- c. Has the possibility of an inter-institutional program or other cooperative effort been explored? What are the results of this study? (Consider not only the possibility of a formally established inter-institutional program, but also how special resources at other institutions might be used on a cooperative basis in implementing the proposed program solely at the requesting institution.)

The leadership of the business colleges at SUI and ISU are in conversation to identify possible ways for collaboration if both proposals are approved. One potential approach is to reach an articulation agreement between the two programs in order to provide maximum flexibility for students to complete their degrees and training in either institution. It is also possible for UNI to leverage the online courses offered in our program to develop concentrations and extensions related to business analytics in their degree programs.

- d. Do other colleges in Iowa offer programs similar to the proposed program at comparable quality and cost?

We are not aware of any similar programs being offered in any of the other colleges located in the State of Iowa.

4. **Estimate the number of majors and non-majors students that are projected to be enrolled in the program during the first seven years of the program.**

a. **Undergraduate**

Undergraduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors							
Non-Majors							

b. **Graduate**

Graduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors	20	40	80	80	80	80	80
Non-Majors							

c. **What are the anticipated sources of these students?**

Initially the anticipated sources of these students will come from industrial partners within and around the state of Iowa such as Kingland Systems, Principal Financial and Boeing (see letters of support). The history of ISU online graduate programs began with sources from Iowa industry and then grew to sources well beyond our state borders. We expect the business analytics program to parallel this experience. We also may market and promote the program through external consultants and advisory services to the national and international markets.

5. **If there are plans to offer the program away from the campus, briefly describe these plans, including potential sites and possible methods of delivery instruction. Will off-campus delivery require additional HLC accreditation?**

This proposed program will be offered primarily through distance education. Engineering-LAS Online learning unit will provide the technical support to capture and deliver these courses to students around the world. The three one-week on campus experience will be delivered at the ISU campus in Ames. Because it does not have off-campus delivery, we do not believe this program requires additional HLC accreditation.

6. **Has the proposed program been reviewed and approved by the appropriate campus committees and authorities?**

The proposal has been reviewed and approved by:

- Industrial & Manufacturing Systems Engineering Curriculum Committee
- Industrial & Manufacturing Systems Engineering Faculty
- Statistics
- Computer Science
- Computer Engineering
- Business College Curriculum Committee
- Business College Faculty
- Graduate College Curriculum and Catalog Committee
- Graduate Council
- Graduate Dean
- Faculty Senate Curriculum Committee
- Academic Affairs Council

The proposal will be forwarded to the following for review and approval:

- Faculty Senate

7. **List date the program proposal was submitted to the Iowa Coordinating Council for Post High School Education (ICCPHSE) and results of listserv review.**

To be submitted

8. **Will the proposed program apply for programmatic accreditation? When?**

The program will be covered by College of Business accreditation starting in 2019.

9. **Will articulation agreements be developed for the proposed program? With whom?**

We are in discussion with SUI about possible collaboration that could include an articulation agreement between this program and a similar program SUI is proposing. While UNI does not have a similar program or proposal at this time, it is possible that some form of articulation agreement can be developed for their current or future programs related to business analytics.

10. **Describe the faculty, facilities, and equipment that will be required for the proposed program.**

Faculty from the colleges of Business, Engineering, and Liberal Arts and Sciences will teach the courses in the proposed program. A new initiative hiring 12 faculty in 2014 to form a big data cluster has provide the additional faculty resources to meet the teaching and research demands of the program.

The courses will be offered through the Engineering-LAS Online (ELO) learning facilities. ELO's facilities are excellent for offering distance education courses and have the necessary capacity

to handle the additional course load (many of the courses required for the proposed program are already offered through ELO).

11. From where will the financial resources for the proposed program come (list all that apply, e.g., department reallocation, college reallocation, grants, new to the university)?

SOURCES (Annual)	TOTAL AMOUNT
Tuition (Year 1)	\$241,680
Tuition (Year 2)	\$604,200
Tuition (Year 3)	\$966,720
Tuition (Year 4 and beyond)	\$966,720
Note: Tuition is calculated based on current ISU rate, assuming 50% in-state and 50% out-state in each cohort, and each student takes 3cr in Summer, 6cr in Fall, and 6cr in Spring in one academic year.	

12. Estimate the total costs/total new costs (incremental increases in expenditures) that will be necessary for the next seven years as a result of the new program:

	TOTAL COSTS	TOTAL NEW COSTS
Year 1	\$305,000	\$305,000
Year 2	\$580,000	\$275,000
Year 3	\$597,400	\$17,400
Year 4	\$615,322	\$17,922
Year 5	\$633,782	\$18,460
Year 6	\$652,795	\$19,013
Year 7	\$672,379	\$19,584
Note: 3% annual inflation is assumed when calculating costs		

13. Include any additional information that justifies the development of this program.

The program will be self-sustaining after the first year as the enrollment rises to 40-student cohorts. We have also listed here the competitive landscape for a business analytics graduate program.

Institution	Degree	Structure	Duration	Delivery	Total Credits	Fee
Iowa State University	Master of Business Analytics	10 courses	21 months	Blended	30 credits	\$15,600 in-state \$32,800 out-state
University of Texas at Austin	MS in Business Analytics	8 core and 8 electives	11 months	On campus full time	34 credits	\$32,000 in-state \$38,000 out-state
Michigan State	MS in Business Analytics	10 courses required	11 months	Blended	30 credits	\$36,000 in-state \$39,000 out-state
Arizona State Univ.	MS in Business Analytics	10 course lock step program	9 months	On campus, full-time	30 credits	\$29,820 in-state \$44,810 out-state
University of	MS in Business	26 credit	24	On campus,	38	Regular

Tennessee	Analytics	core, 12 credit elective	months	full-time	credits	tuition
Purdue University	MBA with Business Analytic Track	4 foundation courses and 1 elective		On campus, full-time		
Louisiana State University	MS in Analytics	36 required credits		On campus, full-time	36 credits	
Indiana University	Graduate Certificate in Business Analytics			Blend (On campus + Online)	12 credits	
University of Minnesota	No Business Analytics					
University of Illinois	MS in Statistics – Analytics Concentration					
University of Nebraska	No Business Analytics graduate program					
University of Missouri	MBA with Marketing Analytics					
University of Wisconsin	No Business Analytics program					
University of Iowa	Business Analytics and Information Systems at undergraduate; Graduate program proposed	10 courses		Face-to-face	30 credits	\$665 per credit for in-state
University of Northern Iowa	No Business Analytics program					

Listed below is a sample curriculum of the proposed degree program.

Semester	Courses	Credits	Teaching Department	Delivery
Summer I	MIS 547: Teams, Projects, and BA Leadership	3	SCIS	<b>On campus</b>
Fall I	MIS 536: Business Analytics Foundation	3	SCIS	Online
	STAT 502: Applied Statistical Modeling	3	Statistics	Online
Spring I	STAT 581: Data Analytics and Visualization	3	Statistics	Online
	I E 583: Knowledge Discovery and Data Mining.	3	IMSE	Online
Summer II	MKT 552: Marketing Analytics with Big Data	3	Marketing	<b>On campus</b>
Fall II	MIS 546: Advanced Business Analytics	3	SCIS	Online
	COM S 535: Algorithms for	3	Computer	Online

	Large Data Sets: Theory and Practice		Engineering/Computer Science	
Spring II	MIS 556: Business Analytics Capstone Project (Capstone)	3	SCIS	<b>On campus</b>
	STAT 451: Applied Time Series (Forecasting) or STAT 510: Applied Modern Multivariate Statistical Learning	3	Statistics	Online

## Master of Business Analytics

### List of Courses

(November 4, 20014)

#### Existing Courses

##### **I E 583. Knowledge Discovery and Data Mining (3-0) Cr. 3.**

Prereq: I E 148, I E 312, and STAT 231

Introduction to data warehouses and knowledge discovery. Techniques for data mining, including probabilistic and statistical methods, genetic algorithms and neural networks, visualization techniques, and mathematical programming. Advanced topics include web-mining and mining of multimedia data. Case studies from both manufacturing and service industries. A computing project and an additional project with more theoretical content are required.

##### **Stat 451. Applied Time Series (3-0) Cr. 3.**

Prereq: STAT 301, STAT 326, or STAT 401

Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Introduction to multivariate time series methods.

#### New Courses

##### **COM S 535. Algorithms for Large Data Sets: Theory and Practice (3-0) Cr. 3.**

Prereq: COM S 228, COM S 330, CPRE 310, or department permission

Challenges involved in solving computational problems associated with massive data sets. Computational problems arising in the context of web search, social network analysis, recommendation systems, and online advertising. Theoretical aspects include modeling computational problems using graphs, study of similarity measures and hash functions, and design of efficient algorithms for graphs. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

##### **\*MIS 547. Teams, Projects, and BA Leadership (3-0) Cr. 3.**

Prereq: Admission to the program or department permission.

Preparation of students in teamwork and project management skills, including teach cohesion, synergies, and team commitment. Emphasis on developing skills to monitor/assess motivation and enhance productivity and quality. Discussion of both leadership theory and different leadership styles; expectations about communicative protocols/methods, appropriate media, scheduling communication, and the use of templates and collaborative systems.

##### **\*MIS 536. Advanced Business Analytics (3-0) Cr. 3.**

Prereq: MIS 547 or department permission.

In-depth discussion of various advanced topics in Business Analytics, such as big data, text mining, web mining, and social network analysis. Extensive hands-on exercises using analytic tools to solve real-world problems.

**\*MIS 546. Business Analytics Foundation (3-0) Cr. 3.**

Prereq: MIS 536 or department permission.

Introduction to basic concepts and tools in Business Analytics. Hands-on laboratory exercises and business case studies on data preparation, data representation, data visualization, and data mining. Focus on predictive analytics; descriptive and prescriptive analytics will also be explored.

**MIS 556. Business Analytics Capstone Project (3-0) Cr. 3.**

Prereq: Department permission

Syntheses of analytics concepts, skills, and practices learned during the program of study to complete a course project. Projects proposals relevant to a firm are proposed and accepted midway through the program. Student cohort teams will complete the capstone project under the supervision of an advisory team of faculty. Teams will present their projects to mark the completion of the program of study.

**MKT 552. Marketing Analytics with Big Data (3-0) Cr. 3.**

Prereq: Admission to the program or department permission

Principles and methods of market segmentation, market response models; principles of resource attribution across customer-touching points, social media marketing and mobile commerce. Current research and industry best practices, tools and methods to draw customer insights, and develop actionable marketing strategies with hands-on experiences.

**STAT 502. Applied Statistical Modeling (3-0) Cr. 3.**

Prereq: STAT 226, equivalent, or department permission

Introduction to probability concepts and distributions used in statistical decision-making. Least squares and maximum likelihood estimation, sampling distributions of estimators; confidence intervals and hypothesis testing; analysis of variance; applications of multiple regression models, logistic regression and Poisson regression; strategies for model selection; introduction to decision trees and model averaging; introduction to conditional probabilities and Bayesian analysis. Applications implemented with R statistical package. Simulations used to investigate properties of estimation procedures and assist in data analysis.

**STAT 510: Applied Modern Multivariate Statistical Learning (3-0) Cr. 3.**

Prereq: STAT 502, IE 583, MIS 546, or department permission.

Advanced application of statistical methods for modern data mining and machine learning; inference and prediction; variance-bias trade-offs and choice of predictors; kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; support vector machines; random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling.

**STAT 581. Data Analytics and Visualization: (3-0) Cr. 3.**

Prereq: Admission to the program or department permission

Discussion of exploratory data analysis and visualization strategies and application to data with a focus on business processes and forecasting. Basic types of charts, time series displays, multi-layered charts, and maps. Discussion and development of interactive graphics in the form of web-based applications; cognitive principles of visualizations such as features of good graphics, important perceptual elements, and consideration of audience perception of a graphic; tools for implementing good graphics.

Note: Courses with \* are already in the experimental course catalog system.

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

College of Business

Department of Supply Chain  
and Information Systems  
David & Deb Kingland SCIS Suite  
2340 Gerdin Business Building  
Ames, Iowa 50011-1350  
515-294-3659  
FAX 515-294-2534

November 17, 2014

Professor David Cantor  
Chair  
College of Business Curriculum Committee

Dear Dr. Cantor,

The faculty of the Department of Supply Chain and Information Systems supports the graduate on line master of business analytics. As Chair I fully support the program and recently hired a tenure track faculty to complement the existing information systems faculty and augment the needs of the new program. The program will further add value to the campus-wide effort to create a "Big Data" cluster of researchers and resources.

The department will not only house and manage the program but will provide four of the required course in the curriculum. Moreover, the department welcomes the collaboration from the other participating departments.

Sincerely,



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Sree Nilakanta  
Chair, SCIS

November 17, 2014

Professor Sree Nilakanta  
Chair, Department of Supply Chain and Information Systems  
College of Business

Dear Professor Nilakanta,

The Department of Marketing supports the graduate on-line Master of Business Analytics proposal. As Chair of the Department, I fully support the program and recently hired a tenure-track faculty to augment the needs of the new program. The program will add value to the campus-wide effort to create a "Big Data" cluster of researchers and resources.

Moreover, the Marketing Department will provide a course in the curriculum focusing on the marketing analytics and "big data." Additional courses may be available as electives to qualified students in the program.

Sincerely,

Russell N. Laczniak, Chair  
Professor of Marketing  
John and Connie Stafford Faculty Fellow

**IOWA STATE UNIVERSITY**  
OF SCIENCE AND TECHNOLOGY

Statistical Laboratory and  
Department of Statistics  
102 Snedecor Hall  
Ames, Iowa 50011-1210  
Phone: (515) 294-3440  
Fax: (515) 294-4040

September 11, 2014

Professor Sree Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
2340 Gerdin Business Building  
Iowa State University

**Dear Dr. Nilakanta,**

The Department of Statistics faculty eagerly accepts your invitation to participate in the new Master of Business Analytics degree program. The Statistics faculty has reviewed the proposal and believes that the proposed program has a strong quantitative and technical foundation and it will provide participants the skills needed to model market behavior and build effective models for descriptive and predictive analyses. The Statistics Faculty voted 28 in favor and none opposed to the proposed program, with 4 faculty members abstaining. I am happy to convey our support to you.

The Department of Statistics will provide a basic course in statistical analysis that will be modelled after Stat 401, a course we currently offer to graduate students in a variety of disciplines. This course will be modified to include business applications and statistical methods with important applications in business analytics. The Department of Statistics will also develop three additional courses on time series analysis and forecasting, data visualization, and on advanced statistical methods for modern unsupervised statistical learning. The last course will expand on an introductory data mining course that will be offered to students in the first year of the proposed two year program. All of these courses will be developed from courses or parts of courses that we already offer.

There is a growing demand for the types of students you will educate with this Master of Business Analytics Program, and we believe the program will be very successful. We look forward to helping you develop the proposed program.

Sincerely,



Kenneth Koehler  
Chair, Department of Statistics  
Iowa State University

# IOWA STATE UNIVERSITY

College of Engineering

Department of Industrial and  
Manufacturing Systems Engineering  
3004 Black Engineering Building  
Ames, Iowa 50011-2164  
Tel. 515 294-1682  
FAX 515 294-3524  
www.imse.iastate.edu

May 9, 2014

Professor Sree Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
2340 Gerdin Business Bldg.,  
Iowa State University

Dear Dr. Nilakanta,

Thank you for your work to develop the proposal for a new Master of Business Analytics degree program. As a co-developer of the program I have carefully reviewed the proposal and sought input and approval from our departmental curriculum committee as well as the faculty as a whole. I am happy to convey to you that in both cases, the vote was unanimously positive. We look forward to working with you and your faculty and believe strongly in interdisciplinary programs and the value of collaboration. We are also in full agreement with your assessment that the proposal to rename the Operations Research program to Operations Analytics addresses a different set of students (on-campus students versus off-campus working professionals, with different objectives and program content and needs).

There is a substantial and growing demand of the type of student you will train with this Master of Business Analytics Program. I anticipate the program will be very successful. We look forward to providing the necessary collaboration and support for your program.

Respectfully,



Janis Terpenney, Department Chair and  
Joseph Walkup Professor

May 5, 2014

From: Professor Gianfranco Ciardo  
Chair, Computer Science  
College of Liberal Arts and Sciences  
226 Atanasoff Hall  
Iowa State University

To: Professor Sree Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
2340 Gerding Business Bldg.  
Iowa State University

Dear Dr. Nilakanta,

Thank you for sharing your proposal for a new Master of Business Analytics degree program. As a co-developer of the program I have carefully reviewed the proposal and sought input from few other faculty who teach and do research in areas covered by the proposal. We believe that the proposed program has a strong quantitative and technical foundation that will provide participants the skills needed to model market behavior, build effective models for descriptive and predictive analyses. I am happy to convey to you my endorsement of the proposal.

I expect that several graduate computer science courses (COM S 526 Parallel Computing, COM S 555 Simulation: Algorithms and Implementation, COM S 556 Analysis Algorithms for Stochastic Models, COM S 572 Principles of Artificial Intelligence, COM S 573 Machine Learning, and COM S 673 Advanced Topics in Computational Intelligence) will constitute an important component of the elective classes for this program, and our department is looking forward to working with students enrolled in this program.

There is a substantial and growing demand of the type of student you will train with this Master of Business Analytics Program. I anticipate the program will be very successful. We look forward to providing the necessary support for your program.

Sincerely yours,



Gianfranco Ciardo  
Professor and Chair, Department of Computer Science, Iowa State University

Professor Sree Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
2340 Gerdin Business Building  
Iowa State University

Dear Dr. Nilakanta,

The Department of Electrical and Computer Engineering eagerly accepts your invitation to participate in the new Master of Business Analytics Program. The Computer and Software engineering faculty has reviewed the proposal and believes that the proposed program has a strong technical and quantitative foundation.

The department will provide a required course in the curriculum focusing on the technical foundations of analytics and “big data.” Additional courses may be available as electives to qualified students in the program.

There is a growing demand for the types of students you will educate with this Master of Business Analytics Program. We look forward to helping you develop the proposed program.

Sincerely,

David Jiles  
Chair, Electrical and Computer Engineering



Scott Wannarka  
114 Welch Ave.  
Ames, IA 50014  
May 5, 2014

Dr. Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
Iowa State University  
2340 Gerdin Business Bldg.,  
Ames, IA 50011

Dear Dr. Nilakanta:

This letter is to inform you of our interest in the Master of Business Analytics degree program currently under consideration at Iowa State University. For the past several years, we have been active in supporting the department through our participation on the advisory council and other forms of student and faculty engagement.

Members of my staff and others at Kingland Systems provided input to you regarding content that would be of interest to us in developing analytic skills of our managers. We appreciate the effort you have put into the development of this proposal.

I believe a Master of Business Analytics, especially one that is jointly developed with Statistics, Computer Science, and Engineering, is an advanced degree that would assist in the professional development of our scientists, engineers and managers who have chosen a managerial career focus. We also appreciate that the program will be available on line.

As both an alumnus (Com Sci '87) and an Ames employer, I look forward to hearing more about the program and promoting it to our employees as it becomes available in the future.

Sincerely,

A handwritten signature in black ink that reads "Scott Wannarka". The signature is written in a cursive, flowing style.

Scott Wannarka  
Managing Director, Technology



The Boeing Company  
P.O. Box 3707  
Seattle, WA 98124-2207

June 4, 2014

Dr. Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
Iowa State University  
2340 Gerdin Business Bldg.  
Ames, IA 50011

Dear Dr. Nilakanta:

This letter is to inform you of our interest in the Master of Business Analytics degree program currently under consideration at Iowa State University. The Boeing Company has been active in supporting the SCIS department through the advisory council as well as ongoing support and engagement through charitable donations for student scholarships, funding for student organizations and through recruiting for internships and full time positions. Additionally I've been expanding the engagement with the faculty with a special focus on Big Data and Analytics.

I appreciate the opportunity to have provided input regarding program content that would be of interest for Boeing as we work to develop our team capability in this arena. I anticipate that we will leverage the program through distance learning for our current employees as well as pursuing graduates as potential employees for Boeing. If the program is approved I'm also interested to discuss options and ideas for capstone projects.

I believe a Master of Business Analytics that focuses on Statistics and Engineering in addition to the IT aspects of software tools and data manipulations would be a particularly effective program. We are finding that our most effective data scientists and top analytics drivers are people who have a broad understanding of the business environment and the relationships within the data. I'm pleased to see the proposed degree content as I believe it will be a great foundation for technical practitioners, business process consumers, and managers.

I look forward to hearing more about the program and promoting it to our employees as it becomes available in the future.

Sincerely,

A handwritten signature in blue ink that reads "Nancy Bailey".

Nancy Bailey  
Vice President, IT Business Partners



Group Non-Medical Benefits  
Sales and Service

Principal Life  
Insurance Company

Ann Sandve  
4141 ParkLake Ave., Suite 400  
Raleigh, NC 27612  
June 9, 2014

Dr. Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
Iowa State University  
2340 Gerdin Business Bldg.,  
Ames, IA 50011

Dear Dr. Nilakanta:

This letter is to inform you of our interest in the Master of Business Analytics degree program currently under consideration at Iowa State University. For the past several years, we have been active in supporting the department through our participation on the advisory council and other forms of student and faculty engagement.

Members of my staff and others at Principal Financial Group provided input to you regarding content that would be of interest to us in developing analytic skills of our managers. We appreciate the effort you have put into the development of this proposal.

I believe a Master of Business Analytics, especially one that is jointly developed with Statistics, Computer Science, and Engineering, is an advanced degree that would assist in the professional development of our scientists, engineers and managers who have chosen a managerial career focus. We also appreciate that the program will be available on line.

I look forward to hearing more about the program and promoting it to our employees as it becomes available in the future.

Sincerely,

A handwritten signature in blue ink that reads "Ann Sandve".

Ann Sandve  
Assistant Vice President-IT

May 5, 2014

Dr. Nilakanta  
Chair, Supply Chain and Information Systems  
College of Business  
Iowa State University  
2340 Gerding Business Bldg.,  
Ames, IA 50011

Dear Dr. Nilakanta:

This letter is to inform you of our interest in the Master of Business Analytics degree program currently under consideration at Iowa State University. For the past several years, we have been active in supporting the department through our participation on the advisory council and other forms of student and faculty engagement.

I have contributed in conversations in our advisory board meetings and provided input to you regarding content that would be of interest to us. I can't at this time offer insight to the interest members of C.H. Robinson might have in the program, but do feel graduates of this program would have attractive skills for a select set of roles at C.H. Robinson. We appreciate the effort you have put into the development of this proposal.

I believe a Master of Business Analytics, especially one that is jointly developed with Statistics, Computer Science, and Engineering, is an advanced degree that would assist in the professional development of young professionals who have chosen a data science or managerial career focus. The online offering is perceived as valuable to attract a wider audience than a full time, on campus program.

I look forward to hearing more about the program and promoting it to our employees as it becomes available in the future.

Sincerely,

Steve Raetz  
Director, Research and Market Intelligence  
14701 Charlson Road  
Eden Prairie, MN 55347