Management Sciences

Chair

• Nick Street

Undergraduate major: business analytics and information systems (B.B.A.)

Graduate degrees: M.S. in business analytics; management sciences subprogram for the Ph.D. in business administration

Faculty: http://tippie.uiowa.edu/management-sciences/faculty.cfm

Web site: http://tippie.uiowa.edu/management-sciences/

The Department of Management Sciences specializes in using advanced computation and mathematical techniques to solve critical business problems. Its strengths in research and instruction include operations management, business analytics, information systems, and quantitative methods.

Undergraduate Program of Study

• Major in business analytics and information systems (Bachelor of Business Administration)

Bachelor of Business Administration

The Bachelor of Business Administration with a major in business analytics and information systems requires a minimum of 120 s.h., including 21 s.h. of work for the major. The program provides a variety of educational experiences that develop students' knowledge of managerial decision-making systems. Students acquire skill in applying this knowledge by constructing quantitative models, using computer technology, and creating database systems.

The major prepares students for career opportunities in both manufacturing and service organizations. Graduates find entry-level work as computer programmers, systems analysts, sales representatives with computer companies, and management trainees. Entry-level work in operations management is found in materials management, line supervision, purchasing, and manufacturing systems.

All B.B.A. students majoring in business analytics and information systems choose one of two tracks: business analytics or information systems.

COMMON REQUIRED COURSES

Students in both tracks must complete these three courses.

MSCI:3030 Business Process Analysis 3 s.h.
MSCI:3200 Database Management 3 s.h.
MSCI:4250 BAIS Capstone Project 3 s.h.

BUSINESS ANALYTICS TRACK

Students in the business analytics track complete all of these:

MSCI:3025 Decision Support Systems 3 s.h.
MSCI:3500 Business Intelligence 3 s.h.
MSCI:3800 Optimization and Simulation Modeling 3 s.h.

INFORMATION SYSTEMS TRACK

Students in the information systems track complete all of these:

MSCI:3020 Business Programming 3 s.h.
MSCI:3300 Software Design and Development 3 s.h.
MSCI:3400 Data Communications 3 s.h.

ELECTIVES (BOTH TRACKS)

All students complete at least 3 s.h. from these:

MSCI:3100 Applied Information Systems 3 s.h.
MSCI:3920 Supply Chain Management 3 s.h.
MSCI:4220 Database Management and Web Services 3 s.h.
MSCI:4280 Computer Networks and Security 3 s.h.
CS:1210 Computer Science I: Fundamentals 4 s.h.
ECON:3355 Economic and Business Forecasting 3 s.h.

Any computer science course for which CS:1210 is a prerequisite 3-4 s.h.
Any course required for the nonselected track 3 s.h.

Graduate Program of Study

• Master of Science in business analytics
• Management sciences subprogram for the Doctor of Philosophy in business administration

The department offers a Master of Science in business analytics and administers a Certificate in Business Analytics; see Business Analytics in the Catalog. They also offer a management sciences program for the Ph.D. in business administration. In addition, the department participates in the M.B.A. program, which is offered by the Tippie School of Management; see Master of Business Administration Program in the Catalog.

Master of Science

The Master of Science program in business analytics requires a minimum of 30 s.h. of graduate credit, of which 24 s.h. must be unique to the M.S. degree. The 24 s.h. can include 15 s.h. earned toward the Certificate in Business Analytics; the program is designed so that students can move into the M.S. program upon completion of the certificate. No thesis is required. A cumulative g.p.a. of at least 2.75 is required in all course work.

Students may be allowed to apply up to 6 s.h. of course work from another institution toward the M.S. with approval by petition to the director of the master's program.

Applicants must meet the admission requirements of the Graduate College; see Manual of Rules and Regulations of the Graduate College.

The digital revolution empowered by the Internet and computer technology in business and individual life during the last several decades has generated unimaginable amounts of data in the form of digital records stored in databases and file servers. The volume, velocity, and variety of these data have produced a new set of...
problems and challenges for businesses and organizations in their pursuit of competitiveness, effectiveness, and efficiency. These problems and challenges also have created unprecedented opportunities for businesses and organizations to discover, model, understand, and serve their customers and partners in ways never imagined and to supply details never possible before. Businesses and organizations that are able to master this volume of data will have a tremendous competitive advantage over their competition in the marketplace.

As the need for implementing data analytic solutions grows, demand for professionals who understand and are capable of working with and exploring this data has exploded in recent years. This program addresses the growing need to manage and analyze the rapidly increasing amount of data that is available to support business decision making.

Students complete 15 s.h. in core courses, a capstone project, and 12 s.h. in elective course work. The capstone course is a group project that solves a real-world business problem. Elective course work allows students to deepen or broaden their skills.

The following course work is required.

**CORE COURSES**

All of these:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MSCI:6070 Data Science</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>MSCI:9100 Business Analytics</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>MSCI:9110 Advanced Analytics</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>MSCI:9210 Introduction to Modeling with VBA</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>MSCI:9230 Database Systems</td>
<td>3 s.h.</td>
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</tbody>
</table>

**CAPSTONE COURSE**

This course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Capstone/Real-World Project</td>
<td>3 s.h.</td>
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</tbody>
</table>

**ELECTIVES**

Students select 12 s.h. from the following.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MSCI:9180 Statistical Methods for Process Improvement</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>A text analytics course</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>A programming and databases for big data course</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>An operations analytics course</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>A health care analytics course</td>
<td>3 s.h.</td>
</tr>
<tr>
<td>A marketing analytics course</td>
<td>3 s.h.</td>
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**Doctor of Philosophy**

Graduate students in management sciences may earn a Doctor of Philosophy in business administration. For a description of the Ph.D. program and requirements, see Doctor of Philosophy in the Catalog and visit the Department of Management Sciences web site.

Applicants must meet the admission requirements of the Graduate College; see Manual of Rules and Regulations of the Graduate College.

**Courses**

**Lower-Level Undergraduate**

**MSCI:1300 First-Year Seminar** 1 s.h.
Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities).

**MSCI:1500 Business Computing Essentials** 2 s.h.
Basic proficiency with common business application software (word processing, spreadsheet, presentation software, database); simulation training to achieve requisite skills; additional support available via optional textbook or ebook; online, modular, self-taught course.

**Upper-Level Undergraduate and Graduate**

**MSCI:3000 Operations Management** 3 s.h.
Strategic, tactical, operational issues that arise in management of production and service operations; product and process design, facilities planning, quality management, materials management, operations planning and scheduling, emerging technologies in production and service management. Prerequisites: STAT:1030. Requirements: junior standing.

**MSCI:3005 Information Systems** 3 s.h.
Application of computing principles to solving business problems; information technology in modern organizations; focus on sound data analysis to support decision making; tools used for problem solving (spreadsheets, databases, web applications); role of information systems in organizations; components of information technology; Internet and network economy; basic data analysis and visualization; decision-making logic represented as algorithms; perform what-if analysis with data; emerging technologies. Prerequisites: MSCI:1500.

**MSCI:3020 Business Programming** 3 s.h.
Introduction to algorithms, data structures, and object-oriented programming constructs to solve business problems. Prerequisites: MSCI:3005.

**MSCI:3025 Decision Support Systems** 3 s.h.
Introduction to programming Visual Basic for Applications in Excel to develop spreadsheet-based decision-support systems. Prerequisites: MSCI:3005.

**MSCI:3030 Business Process Analysis** 3 s.h.
Design, management, and improvement of business processes; data-driven approach to map a value stream and analyze industrial and service-oriented business processes to identify improvement opportunities; discrete-event simulation tools utilized to model business processes and demonstrate effect of variability on process performance metrics; role of information systems to increase an organization's efficiency; project management skills with particular emphasis on understanding issues involved in designing an information system to successfully support a business operation. Prerequisites: MSCI:3000.
MSCI:3070 Management Sciences Topics  
Special topics in management sciences and information systems.

MSCI:3100 Applied Information Systems  3 s.h. 
Application of computer technology to accounting and transaction processing systems; information systems infrastructure and trends; problem solving with microcomputer spreadsheets, databases; accounting cycle operations. Prerequisites: ACCT:2100 and ACCT:2200 and MSCI:3005. Same as ACCT:3600.

MSCI:3200 Database Management  3 s.h. 
Design and implementation of a database using relational DBMS; emphasis on issues of logical and physical design, database administration, concurrency control, maintenance. Prerequisites: MSCI:3005.

MSCI:3300 Software Design and Development  3 s.h. 
Design and implementation of an information system; emphasis on programming and stages of software design life cycle, implemented using UML. Corequisites: MSCI:3020, MSCI:3030, and MSCI:3200; if not taken as prerequisites.

MSCI:3400 Data Communications  3 s.h. 
Computer communications: computer-communication system, hardware, data transmission principles; examples of existing communication networks; related managerial issues. Prerequisites: MSCI:3005.

MSCI:3500 Business Intelligence  3 s.h. 
Introduction to predictive analytics methods motivated by problems in operations, marketing, finance and accounting; data and text mining techniques, including classification, clustering, and association analysis. Prerequisites: ECON:2800.

MSCI:3800 Optimization and Simulation Modeling  3 s.h. 
How to leverage data and apply spreadsheet optimization software and Monte Carlo simulation to form optimal decision policies. Prerequisites: ECON:2800.

MSCI:3920 Supply Chain Management  3 s.h. 
Key issues in design and management of global supply chains; issues in integration of business processes across organizations that are concerned with movement of goods, delivery of services, and information flow along the supply chain in order to create value for the customer; issues in coordinating production and logistics within a firm and with outside suppliers and customers in the supply chain. Prerequisites: MSCI:3000.

MSCI:4050 Directed Readings  arr. 

MSCI:4220 Database Management and Web Services  3 s.h. 
Advanced database management topics and basics of web services; how to retrieve real-world data from web services; use of SQL and PL/SQL to analyze data in relational databases. Prerequisites: MSCI:3200.

MSCI:4250 BAIS Capstone Project  3 s.h. 
Individual or team senior project incorporating track-specific knowledge and skills from BAIS curriculum; projects from real-world customer, (e.g., software system, network design/implementation or data/process analysis); outcomes include written documentation, presentation, project report. Prerequisites: MSCI:3030 and MSCI:3200 and (MSCI:3300 or MSCI:3500). Requirements: 90 s.h. completed.

MSCI:4280 Computer Networks and Security  3 s.h. 
Introduction to network management; emphasis on cost effective, reliable, and secure configuration and management of network switches, routers, clients, servers, and users in local and wide area network architectures; basic router and switch configuration options, routing protocols, VLANS, switch loop avoidance, access control lists, network access control mechanisms, encryption; Public Key Infrastructure and network user security; hands-on activities with routers and switches, Cisco networking simulators, and virtual machines using IPv4 and IPv6 protocols. Prerequisites: MSCI:3400.

MSCI:4900 Academic Internship  arr. 
Professional internship experience with associated academic content.

MSCI:4999 Honors Thesis in Management Sciences  3 s.h. 
Independent student project directed by faculty or staff advisor; culminates in thesis that conforms to University Honors Program guidelines; may include empirical research, library research, applied projects. Prerequisites: BUS:3999 or ECON:3999. Requirements: admission to the Tippie College of Business honors program.

Graduate

MSCI:6060 Data Programming in R  3 s.h. 
Introduction to principles and practices of handling, cleaning, processing, and visualizing data using R programming language; basic programming skills that can be applied to software development in any programming language; variables and data types, control structures, functions and subroutines, arrays and other simple data structures.

MSCI:6070 Data Science  3 s.h. 
Underlying concepts and practical computational skills of data-mining tools including penalty-based variable selection (LASSO), logistic regression, regression and classification trees, clustering methods, principal components and partial least squares; analysis of text and network data; theory behind most useful data mining tools and how to use these tools in real-world situations; software for analysis, exploration, and simplification of large high-dimensional data sets. Prerequisites: MSCI:9100 or MBA:8150.
MSCI:6100 Text Analytics 3 s.h.
Concepts and techniques of text mining; practice of using statistical tools to automatically extract meaning and patterns from collections of text documents; topics include document representation, text classification and clustering, sentiment analysis and topic modeling. Prerequisites: MSCI:9100 and MBA:8150 and MSCI:9060.

MSCI:6190 Knowledge Management 3 s.h.
How organizations acquire, manage, and use information; knowledge management and competitive intelligence, information from inside and outside the organization; organization types, including library, corporate, and nonprofit. Same as SLIS:6190.

MSCI:6200 Database Analysis and Design 3 s.h.
Advanced topics in database management systems.

MSCI:6300 Dynamic Programming 3 s.h.
Fundamentals of discrete sequential dynamic programming with special focus on situations in which outcomes are uncertain; formulation and analysis of deterministic and stochastic dynamic programs under several objective criteria; emphasis on rapidly expanding field of approximate dynamic programming; applications including inventory control, vehicle routing, and resource allocation.

MSCI:6421 Knowledge Discovery 3 s.h.
Knowledge discovery process, including data reduction, cleansing, transformation; advanced modeling techniques from classification, prediction, clustering, association; evaluation and integration. Same as CS:6421.

MSCI:6600 Linear Programming 3 s.h.
Mathematical programming models; linear and integer programming, transportation models, large-scale linear programming, network flow models, convex separable programming. Requirements: calculus and linear algebra. Same as IE:6600.

MSCI:6700 Discrete Optimization 3 s.h.
Introduction to modeling and solving discrete optimization problems; integer programming, network flows, dynamic programming. Prerequisites: MSCI:6600.

MSCI:6800 Web Mining 3 s.h.
Techniques for mining the web and other unstructured or semistructured, hypertextual, distributed information repositories; crawling, indexing, ranking, filtering algorithms.

MSCI:6900 Heuristic Search 3 s.h.
Design of heuristic search algorithms to find good (near-optimal) solutions to difficult (NP-hard) optimization problems that occur in many disciplines; basic heuristic concepts (local search, greedy search, problem decomposition) which serve as fundamental constructs for metaheuristics, including simulated annealing, genetic algorithms, tabu search, variable neighborhood search; introduction to various optimization problems and survey of various heuristic approaches; underlying theoretical structure of several heuristic methods; how to implement a heuristic algorithm.

MSCI:7000 Management Sciences Topics 3 s.h.

MSCI:7850 Research Seminar in Management Sciences 1 s.h.
Current research topics. Requirements: Ph.D. enrollment.

MSCI:7900 Special Topics in Management Sciences arr.

MSCI:7950 Directed Readings arr.

MSCI:7975 Thesis in Management Sciences arr.
Requirements: Ph.D. enrollment.

MSCI:9060 Data Programming in R 2 s.h.
Introduction to principles and practices of handling, cleaning, processing, and visualizing data using R programming language; basic programming skills that can be applied to software development in any programming language; variables and data types, control structures, functions and subroutines, arrays and other simple data structures. Prerequisites: MSCI:9100.

MSCI:9070 Data Science 2 s.h.
Underlying concepts and practical computational skills of data-mining tools including penalty-based variable selection (LASSO), logistic regression, regression and classification trees, clustering methods, principal components and partial least squares; analysis of text and network data; theory behind most useful data mining tools and how to use these tools in real-world situations; software for analysis, exploration, and simplification of large high-dimensional data sets. Prerequisites: MSCI:9100.

MSCI:9100 Business Analytics 3 s.h.
Introduction to analytical techniques for making business decisions; utilizing Excel for application of descriptive and predictive analytical tools to solve practical business problems using real world data; dealing with uncertainty in decision making; formal probability concepts and statistical methods for describing variability (decision trees, random variables, hypothesis testing); application of techniques (linear regression, Monte Carlo simulation, linear optimization) to model, explain, and predict for operational, tactical, and strategic decisions.

MSCI:9110 Advanced Analytics 2-3 s.h.
Development of data-driven, problem-solving skills for prediction of uncertain outcomes and prescription of business solutions; linear and nonlinear regression, Monte Carlo simulation, forecasting, data mining, and optimization utilizing spreadsheets and dedicated software packages. Prerequisites: MSCI:9110 or MBA:8150.

MSCI:9120 Supply Chain Management 3 s.h.
Design, operation, and management of a supply chain; supplier and customer contracting and partnering, inventory, transportation and logistics. Prerequisites: MBA:8190.

MSCI:9130 Seminar in Lean Practices 3 s.h.
Lean principles across the enterprise; real-world applications in manufacturing and service sectors, taught in an interactive approach using hands-on exercises and case studies. Prerequisites: MBA:8190.
**MSCI:9135 Strategy Deployment and Lean Enterprise**  
3 s.h.  
How organizations transform themselves into Lean enterprises that maximize customer value through the elimination of waste; focus on how manufacturing and service organizations successfully align their process improvement efforts to strategic goals of the organization (policy deployment); A3 thinking, strategic planning, balanced scorecard, Lean supply chain, employee engagement, and cultural transformation. Prerequisites: MBA:8190.

**MSCI:9140 Rapid Continuous Improvement**  
3 s.h.  
Hands-on experience working on rapid continuous improvement (RCI) teams sponsored by industrial affiliates of the business college involved in using RCI. Offered spring break.

**MSCI:9160 Supply Chain Analytics**  
3 s.h.  
Application of theory from classroom to real world; classroom learning from MSCI:9180 used to work on a company-sponsored Six Sigma style project to complete requirements for Six Sigma Green Belt certification. Prerequisites: MSCI:9180.

**MSCI:9180 Statistical Methods for Process Improvement**  
3 s.h.  
Strategies to improve quality of products, effectiveness of processes; managerial issues, statistical methods, quality, customer needs, customer satisfaction, quality measures and standards; understanding and reducing variability; builds on MBA:8150; data-based management, statistical process control, control charts, capability indexes, design of experiments. Prerequisites: MBA:8150.

**MSCI:9185 Project Management**  
2-3 s.h.  
Preparation for managing projects and project portfolios; project selection, project planning and budgeting, scheduling, resource allocation, project control; integration of project planning tools, including project management software.

**MSCI:9200 Business Programming**  
3 s.h.  
Introduction to algorithms, data structures, and object-oriented programming constructs to solve business problems. Corequisites: MSCI:3005.

**MSCI:9210 Introduction to Modeling with VBA**  
2-3 s.h.  
Introduction to programming Visual Basic for Applications in Excel; case studies in finance, marketing, operations, accounting.

**MSCI:9220 Introduction to Information Systems**  
3 s.h.  
Effective ways for business firms to harness the power of information technology for strategic purposes; conventional and emerging architectures of information systems; integrated perspective on structural relationships among IT components; emphasis on case studies.

**MSCI:9230 Database Systems**  
3 s.h.  
Theories and methodologies for semantic, logical, and physical database design; entity/relationship diagrams and their mapping to database schemas; normalization; languages for relational database systems, including relational algebra, Structured Query Language, query by example; query optimization and index selection; database and view creation, query and update processing; form and report design; practice with commercial DBMS products; integrity, security, concurrency control, transaction recovery.