

# DATA SCIENCE PROGRAM

Data is a key resource that enables organizations to be effective and remain competitive in today's rapidly changing environment. With the expanding use of the internet, social media, video, sensory data and the internet of things, the volume of structured and unstructured data is growing exponentially. At the same time, technological innovation and the emergence of cloud storage has dramatically driven down the cost of the storing the large volume of data that is being generated. Organizations are now keenly aware that they have large amounts of data available to them, that the data is valuable for achieving competitive success and that they need new technologies and techniques to harness the power of their data. Data Science is an emerging field that addresses these needs of organizations.

Data Science is dedicated to the extraction of insights and knowledge from vast amounts of data and translating the knowledge into action to achieve desired outcomes. By nature data science is multi-disciplinary, drawing from many areas such as mathematics and statistics, information theory and technology, including machine learning, statistical learning, computer programming, data engineering, pattern recognition, visualization, predictive analytics, data warehousing, and high performance computing.

The BSDS is an interdisciplinary program that is designed to provide students with a strong balance in both the theory and practice of creating knowledge from data that can be used by organizations to take reasoned action and to solve real-world problems. It is based on the belief that students need to do more than acquire basic skill set in the areas described above, they must also be comfortable in their ability as story tellers, to explain the importance of the their analysis in ways that can be easily understood by others. To prepare students for a career in data science, students will work on real problems and data during their course of study that are provided by organizations in many different areas including business, nonprofit, health care and sports.

## Faculty

### Department Chair

Dr. Suhong Li

### Professor

Abhijit Chaudhury

### Professor

Richard Glass

### Professor

Suhong Li

### Professor

Alan Olinsky

### Professor

Janet Prichard

### Associate Professor

Kenneth Sousa

### Associate Professor

Chen Zhang

### Assistant Professor

Kevin D. Mentzer

## Lecturer

Michael Salzillo

- Data Science Major (<http://catalog.bryant.edu/undergraduate/collegeofbusiness/datascienceprogram/datasciencemajor>)

## Courses

### ISA 201. Introduction to Information Technology and Analytics. 3 Credit Hours.

Information technology has become deeply integrated with every business function. This course covers the role of Information Technology in supporting business process and major enterprise wide strategic initiatives, including Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), Supply Chain Management (SCM), and e-Business. It examines the competitive impact of evolving technologies such as Mobile Computing and Social Networking. The course also covers the social, ethical, and security issues that arise with the use of technology. Various business scenarios/problems are presented to teach students how to use IT to formulate, analyze, and solve problems and to enhance their analytical skills. Students apply what they have learned and compete "team-to-team" in a sponsored course-wide analytical case.

Session Cycle: Fall, Spring

Yearly Cycle: Annual.

### ISA 201G. Introduction to Global Information Technology and Analytics. 3 Credit Hours.

This course will provide a foundation of information technology concepts and application development in a global context. Students are expected to learn how various information technologies can be used to strengthen the business competitiveness globally, how information culture may vary in different countries, and how this variation may impact the adoption of information technologies. Students are expected to learn managerial issues pertaining to development of global information systems. Students will gain experience with database and spreadsheet tools (Access and Excel) which are necessary to be more productive in a global environment.

Prerequisites: BSIB major and GFOB 100G

Session Cycle: Spring

Yearly Cycle: Annual.

### ISA 203. Honors Business Information Technology and Analytics. 3 Credit Hours.

This course introduces students to the key role that information technology plays in business organizations. Major topics include business information systems, information ethics and social issues, security, database fundamentals, telecommunication, e-commerce, m-commerce and traditional and emerging systems development methodologies. Students will also gain experience in developing a functional database application for a business case and then use the data in the database to create spreadsheet analyses to solve business problems related to the different business functions contained in the business case such as finance, marketing and management.

Prerequisites: Honors Program

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 221. Introduction to Programming. 3 Credit Hours.**

This course introduces computer programming using high level programming languages. The course begins with a review of control structures and data types with emphasis on structured programming, syntax, repetition structures, decision structures, list and array processing. Emphasis is placed on programming methods, including creating and manipulating objects, classes, and using object-oriented tools such as the class debugger. This course also introduces students to the ideas of data abstraction and object-oriented programming. Other topics include simple analysis of algorithms, basic searching and sorting techniques, and an introduction to software engineering issues through code discussions.

Session Cycle: Fall, Spring

Yearly Cycle: Annual.

**ISA 305. Using Technology for Effective Decision Making. 3 Credit Hours.**

This course prepares students to analyze data and solve real-life business problems using spreadsheets and other relevant software. It challenges students to use critical thinking and analysis to find efficient and effective solutions to real-life situations. In addition, it teaches students to deal not only with immediate problems, but the inevitable "what if" scenarios that occur in business situations. Case problems from diverse fields of business, such as accounting, finance, marketing, and operations management, will provide additional practice in a real-world context.

Prerequisites: ISA 201 and junior standing

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 312. Mobile Device Application Programming. 3 Credit Hours.**

This is a course in programming methodologies for mobile applications. Students apply a program development process involving problem definition, graphic design methodologies, and pseudo coding. The course will be devoted to writing, debugging, testing, and deploying a variety of applications for mobile devices. Topics include software development kits for mobile applications, Java, and mobile website development.

Prerequisites: ISA 221

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 314. Visual Basic Programming. 3 Credit Hours.**

This is a course in programming methodologies using the popular Visual Basic.Net Language. Students apply a structured program development process involving problem definition, graphic design methodologies, and pseudo-coding. The course will be devoted to writing, debugging, testing and documenting a variety of programs for business applications. This course will provide students with the background and foundation for their continuing development as programmers.

Prerequisites: ISA 201 and junior standing

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 320. Information Technology in Supply Chain Management. 3 Credit Hours.**

The purpose of this course is to discuss how IT is used to enable supply chain management and to improve the performance of the supply chain. Major topics include the role of IT in the supply chain, enterprise resource planning (ERP), innovative technologies in the supply chain, IT enablers for supply chain performance, and internet based supply chain and supply chain security. Hands-on exercises in a simulated SAP ERP system and real-world cases will be used in helping students understand course concepts. This course is cross-listed with GSCM 320.

Prerequisites: ISA 201 and MGT 201 or MGT 201G

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 321. Advanced Java Programming and Data Structures. 3 Credit Hours.**

This course introduces students to intermediate and advanced features of the Java programming language by building on the foundation provided in ISA 221. Advanced Java topics include recursion, file I/O, abstract classes and interfaces, exception handling, generics, collection classes. The course also introduces students to the fundamental concepts of data structures and the algorithms that proceed from them. Topics include fundamental data structures (including stacks, queues, linked lists, hash tables, trees, priority queues, and graphs) and the analysis of algorithms based upon these data structures.

Prerequisites: ISA 221

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 330. Programming for Analytics. 3 Credit Hours.**

This course introduces students to common programming tools used for Data Science application development. Data analysts often implement their solutions using programming languages such as R and Python. Because of this, it is critical that the data analyst be comfortable in such development environments and be able to understand when a solution needs to be programmatically developed. The course covers hands-on programming techniques for analytics which includes web scraping and other data extraction techniques, data transformation, data staging, data analysis, and finally data presentation and visualization. The course will give the students the confidence they will need to consider themselves programmers and to understand the types of analytics solutions that can be assisted or obtained through programming techniques.

Prerequisites: ISA 221 or ISA 341 or AA 304 or permission of the instructor

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 332. E Business Models. 3 Credit Hours.**

E-Business is doing business activities over an IT platform that uses Internet-related protocols. E-Business activities include not only the business to consumer direct selling over the web but also business-to-business logistics, and all the back-end computer activities within the firm that use Internet protocols. Business organizations are implementing radical changes in the marketing, advertising, and delivery of their products and services. Through the implementation of electronic business technology, organizations are extending their boundaries beyond traditional "bricks and mortar" establishments to a new virtual marketplace that has global reach. Conventional business practices in the areas of advertising, marketing, production, and customer service are being radically transformed by this new platform that permits world-wide connectivity on 24/7 basis.

Prerequisites: ISA 201 and junior standing

Session Cycle: Varies

Yearly Cycle: Annual.

**ISA 341. Database Management Systems Principles. 3 Credit Hours.**

This course focuses on the principles of database design and application development in a database environment. Topics will include foundations of the database approach, objectives of this approach, advantages and disadvantages of database processing. A major emphasis will be placed on the Relational Database Model and will include techniques for designing and normalizing a Relational Database. Student projects will include developing application software using a database system.

Prerequisites: ISA 201

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 343. Infrastructure and Cloud Computing. 3 Credit Hours.**

The computing infrastructure is constantly evolving due to the technological advancement and business needs. This course introduces the hardware, system software, the cloud and their integration to drive and support business. This course also brings together the technical knowledge and managerial knowledge in various class activities to demonstrate computing infrastructure's design, implementation and maintenance. Topics include computer hardware components, operating systems, computer networks, middleware, virtualization and Big Data support.

Prerequisites: ISA 201

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 345. Web Design and Development. 3 Credit Hours.**

This course covers the basic principles of designing and implementing websites, focusing on the client side technologies of web page creation. No programming background is required, although students will learn some programming through scripting languages. Course topics include web graphics, information structuring, development of interactive pages (using forms and JavaScript), event handling, implementation issues and techniques, web accessibility issues, and use of popular web development tools. Students will learn client side web development technologies such as HTML, JavaScript, jQuery, and Cascading Style Sheets.

Prerequisites: ISA 201

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 360. Data Warehousing in the Age of Big Data. 3 Credit Hours.**

The main objective of this course is to provide students with an overview of the design and implementation of distributed, parallel databases that could handle massively large data sets that may include billions of rows of data. The major topic include the introduction of big data and its processing architecture, data warehouse, database components and architecture, data distribution, access, storage and data protection, and database tools and utilities. This course offers practical, hands-on experience with retrieving and manipulating data with Structured Query Language (SQL) using both ANSI standard conventions and Teradata extensions to the language. Students will develop skill sets in these areas using Teradata products and HANA which is a product of SAP.

Prerequisites: ISA 341

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 391. Information Systems and Analytics Internship. 3 Credit Hours.**

ISA internships give students the opportunity for supervised employment in an area where they can apply the information system principles and techniques they have studied through our curriculum. Interns work at least ten hours per week, meet periodically with a supervising faculty member, and prepare a substantive report on their work experience.

Prerequisites: ISA 221 and ISA 341 and junior standing is required.

**ISA 441. Systems Analysis and Information Technology Consulting. 3 Credit Hours.**

Programming is only a small part of designing information systems.

A systems analyst works like an investigative journalist, gathering information about the business problem so that an effective technology solution can be designed and constructed. This course teaches you what to look for and how to find it. You will learn structured techniques and less-structured guidelines which will aid in the search for understanding of the organization, its existing systems, and the proposed system. Programming design techniques are also covered. Teams of students will develop a plan for building a complete computer information system for a real or fictitious company.

Prerequisites: ISA 221 and ISA 341 and senior standing

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 442. Project Management and Practice. 3 Credit Hours.**

This course is intended to provide an introduction to Project Management as it applies to the Information Technology industry. The course will assist analysts, developers, team leaders and managers in developing an understanding of the purpose and benefits of project management by exposure to the concepts, practices, processes, tools, techniques, and resources used by the Project Manager during the project life cycle. The course will closely follow the framework of "best practices" of the Project Management Body of Knowledge, the leading professional standard for project management, with emphasis on its application to software and systems development projects.

Prerequisites: ISA 441 and senior standing

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 445. Advanced Web Programming. 3 Credit Hours.**

This course complements skills and content learned in ISA 345 Web Design and Development. The focus of ISA 345 is on browser/end user aspects of web operations while this course focuses on the server/provider aspects. Students will learn to develop server-side applications that mediate between an information source such as a database and the browser-end programs using popular web-application software. An introduction to XML and server side scripting is also presented.

Prerequisites: ISA 345

Session Cycle: Spring

Yearly Cycle: Alternate Years.

**ISA 460. Big Data Analytics. 3 Credit Hours.**

The explosive growth of structured and unstructured data in the form of emails, weblogs, tweets, sensors, video and text has necessitated the use of Big Data and advanced analytics techniques to support large scale data analytics. This course brings together key Big Data tools on a Hadoop platform to show how to efficiently manage data with three main characteristics; volume, velocity and variety. Topics include the Hadoop platforms, Teradata Aster, social media analytics, link analysis, and stream analytics.

Prerequisites: ISA 221 and ISA 360

Session Cycle: Spring

Yearly Cycle: Annual.

**ISA 470. Managing Global Information Resources. 3 Credit Hours.**

Information systems provide the framework for decision making across the functional areas of an organization and are major enablers of globalization. This course provides a foundation in the principles and concepts of managing information resources in a global environment. The course focuses on alternative approaches to managing information resources such as computers, communication networks, software, data and information in organizations. Students will learn how multinational corporations are using IT to develop business solutions and obtain competitive advantage. Emphasis will be placed on viewing the organization in a global perspective, with the associated technological, cultural and operational issues that influence information resource management. Several real-world cases will be used to enhance students' understanding of the course materials.

Prerequisites: ISA 201 and junior standing

Session Cycle: Fall

Yearly Cycle: Annual.

**ISA 472. IT Security and Risk Management. 3 Credit Hours.**

This course explores IT Security from the perspective of risk management. Assessment of IT systems is critical to developing strategies to mitigate and manage risks. This course focuses on effective assessment strategies that ultimately help the student to implement effective and proactive risk mitigation measures and risk management practices. This course focuses on the IT security threat environment, cryptography, securing networks, access control, firewalls, host hardening, application security, data protections, incident response. A clear theoretical understanding supports a practical component. Students will learn to audit information systems and use contemporary security software including intrusion big data analysis.

Prerequisites: ISA 201 and junior standing

Session Cycle: Spring

Yearly Cycle: Alternate Years.

**ISA 497. Directed Study in Information Systems and Analytics. 3 Credit Hours.**

This course provides an opportunity for senior information systems and analytics majors to do independent, in-depth study or research. The student works on an individual basis under the direction of a member of the ISA department. Normally the course requires the student to develop a substantial paper or project.

Prerequisites: Permission of the instructor and department chair approval.

**ISA ST400. Special Topics in Information Systems and Analytics Introduction to Blockchain. 3 Credit Hours.**

This course introduces students to blockchain technology. Students will gain a full understanding of the technology from a management perspective. Students will gain the knowledge needed to understand where this emerging technology is being used and explore why companies are choosing to build their business on blockchain. We will explore how different vertical markets are using blockchain. The second half of the course will be hands-on with the students developing their own smart contract. Students will learn the Solidity programming language in order to write their own smart contracts. Existing smart contracts will be used to discuss techniques and ways to organize code. Heavy emphasis on testing will be done with a bounty like competition being used in the class which will reward students in finding flaws with each other's smart contracts. We will deploy the smart contracts in a private Ethereum environment so students understand the full development life cycle.

Prerequisites: ISA 221 or ISA 312 or ISA 314 or ISA 321 or ISA 330.