Please see the attached course plan to help plan out your registration. You may also consult your Georgia Tech degree audit to view your degree plan. Please let us know if you may have any questions!

CS 6400 – Database Systems Concepts and Design (Computational Data Analytics Track Elective) (Course Preview)

This course presents an example of applying a database application development methodology to a major real-world project. All the database concepts, techniques, and tools that are needed to develop a database application from scratch are introduced. In parallel, learners in the course will apply the database application development methodology, techniques, and tools to their own major class team project. In addition, this course will include instruction in the Extended Entity Relationship Model, the Relational Model, Relational algebra, calculus and SQL, database normalization, efficiency and indexing. Finally, techniques and tools for metadata management and archival will be presented. [Suggested prerequisite - CSE 6040]

CS 6601 - Artificial Intelligence (Computational Data Analytics Track Elective) (Course Preview)

This course is a survey of the field of Artificial Intelligence and will often be taken as the first graduate course in the area. It is designed to be challenging and involves significant independent work, readings, and assignments. The course covers most of the required textbook Artificial Intelligence A Modern Approach 3rd edition, which is a keystone of Georgia Tech's Intelligent Systems PhD qualifier exam.

CS 6750 – Human Computer Interaction (Computational Data Analytics Track Elective) (Course Preview)

This course is an introductory course on human-computer interaction. It does not presuppose any earlier knowledge of human-computer interaction, computer science, or psychology. The class covers three broad categories of topics within human-computer interaction: (a) the principles and characteristics of the interaction between humans and computers; (b) the techniques for designing and evaluating user-centered systems; and (c) current areas of cutting-edge research and development in human-computer interaction.

CS 7280 – Network Science (Computational Data Analytics Track Elective) (Course Preview)

It is often the case that complex systems, both living and man-made, can be represented as static or dynamic networks of many interacting components. These components are typically much simpler in terms of behavior or function than the overall system, implying that the additional complexity of the latter is an emergent network property. Network science is a relatively new discipline that investigates the topology and dynamics of such complex networks, aiming to better understand the behavior, function and properties of the underlying systems. The applications of network science cover physical, informational, biological, cognitive, and social systems. In this course, we will study algorithmic, computational, and statistical methods of network science, as well as various applications in social, communication and biological networks. A significant component of the course will focus on the overlap between machine learning and network science, covering methods for network inference, generative network models, graph embeddings using deep neural networks, and other state of the art topics.

CS 7637 – Knowledge Based AI (Computational Data Analytics Track Elective) (Course Preview)

The twin goals of knowledge-based artificial intelligence (AI) are to build AI agents capable of human-level intelligence and gain insights into human cognition. The learning goals of the Knowledge-Based AI course are to develop an understanding of (1) the basic architectures, representations and techniques for building knowledge-based AI agents, and (2) issues and methods of knowledge-based AI. The main learning strategies are learning-by-example and learning-by-doing. Thus, the course puts a strong emphasis on homework assignments and programming projects. The course will cover three kinds of topics: core topics such as knowledge representation, planning, constraint satisfaction, case-based reasoning, knowledge revision, incremental concept learning, and explanation-based learning; common tasks such as classification, diagnosis, and design; and advanced topics such as analogical reasoning, visual reasoning, and meta-reasoning.

CS 7642 - Reinforcement Learning (Computational Data Analytics Track Elective) (Course Preview)

Reinforcement Learning is a subarea of Machine Learning, that area of Artificial Intelligence that is concerned with computational artifacts that modify and improve

their performance through experience. This course focuses on automated computational decision making through a combination of classic papers and more recent work. It examines efficient algorithms, where they exist, for single-agent and multiagent planning as well as approaches to learning near-optimal decisions from experience. Topics include Markov decision processes; stochastic and repeated games; partially observable Markov decision processes; reinforcement learning; and interactive reinforcement learning. The class is particularly interested in issues of generalization, exploration, and representation.

CS 7643 – Deep Learning (Computational Data Analytics Track Elective) (Course Preview)

Deep learning is a sub-field of machine learning that focuses on learning complex, hierarchical feature representations from raw data. The dominant method for achieving this, artificial neural networks, has revolutionized the processing of data (e.g. images, videos, text, and audio) as well as decision-making tasks (e.g. game-playing). Its success has enabled a tremendous amount of practical commercial applications and has had significant impact on society. In this course, students will learn the fundamental principles, underlying mathematics, and implementation details of deep learning. This includes the concepts and methods used to optimize these highly parameterized models (gradient descent and backpropagation, and more generally computation graphs), the modules that make them up (linear, convolution, and pooling layers, activation functions, etc.), and common neural network architectures (convolutional neural networks, recurrent neural networks, etc.). Applications ranging from computer vision to natural language processing, and decision-making (reinforcement learning) will be demonstrated. Through in-depth programming assignments, students will learn how to implement these fundamental building blocks as well as how to put them together using a popular deep learning library, PyTorch. In the final project, students will apply what they have learned to real-world scenarios by exploring these concepts with a problem that they are passionate about.

CS 7646 – Machine Learning for Trading (Computational Data Analytics Track Elective) (Course Preview)

This course introduces students to the real-world challenges of implementing machine learning based trading strategies including the algorithmic steps from information gathering to market orders. The focus is on how to apply probabilistic machine learning approaches to trading decisions. We consider statistical approaches like linear

regression, Q-Learning, KNN, and regression trees and how to apply them to actual stock trading situations.

CSE 6040 – Computing for Data Analysis (Foundational course) (Course Preview)

This course is your hands-on introduction to basic programming techniques relevant to data analysis and machine learning. Beyond programming languages and best practices, you'll learn elementary data processing algorithms, numerical linear algebra, and numerical optimization. You will build the basic components of a data analysis pipeline: collection, preprocessing, storage, analysis, and visualization. You will program in some subset of Python, R, MATLAB, and SQL, Analytical Tools the faculty's discretion. This course aims to fill in gaps in your programming background, in preparation for other programming-intensive courses in the OMS Analytics program. If you come to the program with a significant programming background already, you may be eligible for exemption from this course.

CSE 6242 – Data and Visual Analytics (Advanced Core) (Course Preview)

This course introduces students to broad classes of techniques and tools for analyzing and visualizing data Analytical Tools scale. It emphasizes how to combine computation and visualization to perform effective analysis. The course covers methods from each side, and hybrid ones that combine the best of both worlds. Topics covered include big data analytics building blocks, data collection and storage, data cleaning and integration, data visualization, dimensionality reduction, data mining concepts, graph analytics, ensemble methods, etc. Students get experience completing significant computing assignments, and are exposed to a variety of programming languages and software. [Prerequisite - CSE 6040] {Practicum Prerequisite}

CSE 6250 – Big Data Analytics in Healthcare (Computational Data Analytics Track Elective) (Course Preview)

In this course we introduce the characteristics of medical data and associated data mining challenges in dealing with such data. We cover various algorithms and systems for big data analytics. We focus on studying those big data techniques in the context of concrete healthcare analytic applications such as predictive modeling, computational phenotyping and patient similarity. We focus on studying those big data techniques in the context of concrete healthcare analytic applications such as: 1. Predictive modeling: e.g., how to predict disease risks on individual patients 2. Computational phenotyping: e.g., how to convert patient data from electronic health records into meaningful clinical

concepts (phenotypes) 3. Patient similarity: e.g., how to measure similarity between patients within a specific context. We also study big data analytic technology: 1. Scalable machine learning algorithms such as online learning and fast similarity search; 2. Big data analytic systems: a. Hadoop family (MapReduce, Hive, Pig, HBase) b. Spark (SparkSQL, MLlib and GraphX). [Suggested prerequisite CSE 6040]

CSE 6742 – Modeling, Simulation & Military Gaming (Computational Data Analytics Track Elective) (Course Preview)

Computer modeling and simulation offers a unique perspective on events because of the ability to hold some variables constant and change others, and run a scenario repeatedly searching for underlying themes. Computer simulation has been used as an analytical tool in the natural sciences, business, commerce, government and politics. This course focuses on the creation and application of computer simulations to model strategic international events concerning warfare. The course is project-based, requiring computing and international affairs students to work together in multidisciplinary teams to analyze specific questions utilizing computer-based modeling and simulation tools (largely, but not exclusively “NetLogo”).

CSE/ISYE/MGT 6748 – Applied Analytics Practicum (Degree Requirement) (Course Preview)

Practical analytics project experience applying ideas from the classroom to a significant project of interest to a business, government agency, or other organization. [Prerequisites – 8 courses including CSE 6242 and MGT 6203]

CSE 8803 - Applied Natural Language Processing (Computational Data Analytics Track Elective) (Course Preview)

The primary objective of this course is to introduce you to broad classes of techniques and tools for analyzing text data using Natural Language Processing (NLP) algorithms and techniques. The class will emphasize applying pre-processing, processing, and post-processing NLP techniques to analyze and develop NLP models using conventional and deep learning machine learning methods.

ISYE 6402 – Time Series Analysis (Analytical Tools Track or Statistics Elective) (Course Preview)

By the end of this class students will learn standard time series analysis topics such as univariate ARMA/ARIMA modeling, state-space models, (G) ARCH modeling,

forecasting, model identification and diagnostics, and multivariate time series. Students will be given fundamental grounding in the use of some widely used tools, but much of the energy of the course is focused on individual investigation and learning. Assignments will include both theoretical and computer problems. Topics include trend, seasonality, autocorrelation and autocovariance, ARMA and ARIMA models, multivariate time series analysis (e.g., VAR), nonlinear models (e.g., GARCH), high-frequency data, and state-space models.

ISYE 6414 – Regression Analysis (Analytical Tools Track or Statistics Elective) (Course Preview)

By the end of this class students will learn the basics of regression analysis, such as linear regression, model selection and logistic regression, as well as more advanced topics including generalized linear regression and nonparametric regression. Students will be given fundamental grounding in the use of some widely used tools, but much of the energy of the course is focused on individual investigation and learning. Assignments will include both theoretical and computer problems. Topics include simple linear regression, multiple linear regression, variance-bias decomposition and variable selection, logistic regression, generalized linear regression, and nonparametric regression.

ISYE 6420 – Bayesian Statistics (Analytical Tools Track or Statistics Elective) (Course Preview)

This course covers the fundamentals of Bayesian statistics, including both the underlying models and methods of Bayesian computation, and how they are applied. Modeling topics include conditional probability and Bayes' formula, Bayesian inference, credible sets, conjugate and noninformative priors, hypothesis testing, Bayesian regression, empirical Bayes models, and hierarchical Bayesian models. Computational topics include Monte Carlo methods, MCMC, Metropolis-Hasting algorithms, Gibbs sampling, variational Bayes, and other methods for posterior approximation. Various applications of Bayesian statistics will be discussed. [Prerequisite - Calculus-based Introductory Statistics Course]

ISYE 6501 – Introduction to Analytics Modeling (Foundational course) (Course Preview)

This course gives a basic introduction to a wide variety of analytics models and techniques, including the basic ideas behind the models, experience using software to

solve/analyze them, and case studies dealing with combining models to find a complete solution. Modeling approaches covered include classification, clustering, change detection, time series modeling, regression models, design of experiments, probability distributions, probability-based models and simulation, PCA, and optimization. Cross-cutting topics like data preparation, model validation, and variable selection are also covered.

ISYE 6644 – Simulation (Analytical Tools Track or Operations Research Elective) (Course Preview)

The course has three main topics: (a) Introduction to discrete-event simulation models and simulation studies; (b) Organization of simulation languages, and modeling with Arena, a comprehensive simulation package with animation capabilities; and (c) Statistical aspects of simulation, including input analysis, random variate generation, output analysis, and variance reduction techniques. The course will include a small probability/statistics review; hand simulation, spreadsheet simulation, and Arena simulation; general modeling concepts and examples; random variate generation including single random variable generation and random processes, input and output analysis, comparisons of systems, and variance reduction.

ISYE 6650 - Probabilistic Models (Analytics Tools Track and Operations Research Track Elective) (Course Preview)

This course will introduce you to basic techniques for modeling and analyzing industrial systems in the presence of uncertainty. Manufacturing & service systems typically have random components to their behavior such as the demand for products and services. We will learn useful quantitative methods for analyzing, designing, and operating stochastic systems particularly manufacturing and service systems. Much of our attention will be focused on understanding, managing and reducing variability for inventory, production and service systems.

ISYE 6669 – Deterministic Optimization (Analytical Tools Track or Operations Research Elective) (Course Preview)

The course will teach basic concepts, models, and algorithms in linear optimization, integer optimization, and convex optimization. The first module of the course is a general overview of key concepts in linear algebra, calculus, and optimization. The second module of the course is on linear optimization, covering modeling techniques, basic polyhedral theory, simplex method, and duality theory. The third module is onfou

linear optimization and convex conic optimization, which is a significant generalization of linear optimization. The fourth and final module is on integer optimization, which augments the previously covered optimization models with the flexibility of integer decision variables. The course blends optimization theory and computation with various applications to modern data analytics.

ISYE 6740 - Computational Data Analysis (Analytical Tools Track, Computational Data Analytics Track or Statistics Elective) (Course Preview)

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. The course is designed to answer the most fundamental questions about machine learning: What are the most important methods to know about, and why? How can we answer the question 'is this method better than that one' using asymptotic theory? How can we answer the question 'is this method better than that one' for a specific dataset of interest? What can we say about the errors our method will make on future data? What's the 'right' objective function? What does it mean to be statistically rigorous? This course is designed to give graduate students a thorough grounding in the methods, theory, mathematics and algorithms needed to do research and applications in machine learning. The course covers topics from machine learning, classical statistics, and data mining. Students entering the class with a pre-existing working knowledge of probability, statistics and algorithms will be Analytical Tools an advantage, but the class has been designed so that anyone with a strong numerate background can catch up and fully participate. Some experience with coding are expected (Analytical Tools a language of your choice, e.g., MATLAB or Python.) [*Required for Computational Data Analytics Track as either a Track Elective or a Statistics Elective]

ISYE 7406 - Data Mining and Statistical Learning (Analytical Tools Track or Statistics Elective) (Course Preview)

An introduction to some commonly used data mining and statistical learning algorithms such as K-nearest neighbor (KNN) algorithm, linear methods for regression and classification, tree-based methods, ensemble methods, support vector machine, neural networks, and Kmeans clustering algorithm. This course focuses on the understanding of methodology, motivation, and assumptions of different algorithms as well as implementation of these algorithms with data examples using the R statistical software.

ISYE 8803 – Topics on High-Dimensional Data Analytics (Analytical Tools Track or Statistics Elective (Course Preview)

This course focuses on analysis of high-dimensional structured data including profiles, images, and other types of functional data using statistical machine learning. A variety of topics such as functional data analysis, image processing, multilinear algebra and tensor analysis, and regularization in high-dimensional regression and its applications including low rank and sparse learning is covered. Optimization methods commonly used in statistical modeling and machine learning and their computational aspects are also discussed - convex conic optimization, which is a significant generalization of linear optimization. The fourth and final module is on integer optimization, which augments the previously covered optimization models with the flexibility of integer decision variables. The course blends optimization theory and computation with various applications to modern data analytics. [Suggested prerequisite ISYE 6501]

MGT 6203 – Data Analytics in Business (Advanced Core) (Course Preview)

Teaches the scientific process of transforming data into insights for making better business decisions. It covers the methodologies, algorithms, and challenges related to analyzing business data. [Suggested prerequisite ISYE 6501] {Practicum prerequisite}

MGT 6059 – Emerging Technologies (Business Analytics Elective)

Delivered as a 7-week course (Course Preview)

Emerging technologies can change the business environment rapidly and dramatically. The Analysis of Emerging Technologies course helps you identify the implications of emerging technologies via a “timeless” and a “timely” component.

- The “timeless” component is a step-by-step, structured approach for analyzing an emerging technology, including how to seize the opportunities and mitigate the threats that it creates. The approach encapsulates forecasting principles and tools as well as theory about whether an emerging technology is adopted or not.
- The “timely” component is a survey of emerging technologies. The course covers emerging technologies for their own sake as well as to illustrate how to implement the structured approach (i.e., the “timeless” component).

In this way, the course provides you with an approach for analyzing emerging technologies that you can use throughout your career. The course is also a survey of emerging technologies.

MGT 6655 – Business Data Preparation and Visualization (Business Analytics Elective) (Course Preview)

Delivered as a 7-week course

Visualizing data is an important step in understanding data, exploring relationships, and "making a case." With the abundance and relevance of data in almost any type of work, the ability to understand and interpret data has become an indispensable business skill. Data visualization has become a fascinating industry, but the ease of creating visualizations also means that there are many charts out there that are wrong, ineffective, or misleading. The goal of this class is to introduce principles and tools of data visualizations, and to help you create visualizations for two different but related purposes: (1) exploration; and (2) explanation / presentation. "Exploration" is about helping you or other stakeholders understand data and form an opinion, by creating simple charts or building a dashboard. "Explanation," in contrast, is when you use visualizations to convey the results of your analysis in a succinct, convincing manner.

MGT 6727 – Privacy for Professionals (Business Analytics Elective) (Course Preview)

This course takes a multi-disciplinary approach to the study of privacy––a current topic of great international interest for those in technology, policy, law, and/or business. It prepares students to work professionally in the privacy field, with an emphasis on U.S.-based law and practice. Course topics include introduction to privacy, federal and state regulators and enforcement of privacy law, principles of information management, online privacy, the California Consumer Privacy Act, information security and data breach notification laws, European Union privacy laws, medical privacy, financial privacy, education privacy, workplace privacy, privacy issues in civil litigation and government investigations, and emerging issues. The professor draws on her extensive experience in business, government, technology, and law to address current privacy debates.

MGT 8803/6754 – Business Fundamentals for Analytics (Foundational course) (Course Preview)

The overall objective of the course is to provide an accelerated introduction to the basics of management and the language of business, and to provide a framework that will enhance the student's effectiveness as a manager in the business world. The course is taught as a series of business disciplinary modules and the professors who teach the modules represent a diversity of functional areas: Financial Accounting, which

relates to financial reporting and the use of accounting data for internal-to-the-business and external-to-the-business purposes; Managerial Accounting, which is the use of accounting data for product costing and management decision-making purposes; Using Financial Analysis Techniques for Decision Making, which provides a general introduction to finance and capital structure; Entrepreneurial Finance, which includes various venture valuation methods and common sources for venture funding; Marketing, including strategy and the development of tactics to create and harvest demand for the business's products and services; and Business Strategy, including how businesses develop competitive advantage in the marketplace and innovation as a key strategic weapon for driving firm revenue growth and profitability.

MGT 8813 – Financial Modeling (Business Analytics Elective) (Course Preview)

Financial Modeling presents tools necessary to build advanced Excel spreadsheets for business decision making. Students will create spreadsheets using pivot tables, Excel functions, solver, goal seek, and VBA. The course will also include topics such as time value of money, stock and bond valuation, firm valuation, financial statements, cost of capital, option pricing models, and portfolio optimization. This course is intended to prepare students to build financial models. Therefore, two broad learning objectives exist for this course: Finance-based learning objectives and excel/modeling-based learning objectives.

MGT 8823 – Data Analysis for Continuous Improvement (Business Analytics Elective) (Course Preview)

Because it is one thing to know how to analyze data and another thing to actually use it to solve problems, the purpose of this course is to show how mastery of data analysis can be applied to the real world. Because the course weaves examples from both industry and everyday life, what is learned can be directly applied to both your personal and professional lives. In addition to the practical knowledge gained, students will also be shown tools that are outside of the typical analytics course and provided with the knowledge of how to use these tools on their own and in conjunction with the data analysis. Because one must know not only how to analyze data but also how to determine from where the actual data should come, the tools chosen will assist the student in coming up with what to analyze in the first place. Successful completion of this course and a project awards a Lean Six Sigma Green Belt.

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MGT 8833 – Analysis of Unstructured Data (Business Analytics Track and Computational Data Analytics Track Elective) (Course Preview)

Delivered as a 7-week course

The amount of data produced each day has grown exponentially over the last several decades, and much of this data is "unstructured" in the sense that requires considerable transformation before analysis is possible. In this course, students will then learn how to apply a variety of analytical procedures, such as those related to natural language processing (NLP) and machine learning, to transform this unstructured data into an analyzable form and then use this data to make informed business decisions. Students will learn the tools they need to transform data from sources such as web pages, social media posts, and narrative disclosures in firms' financial reports to an analyzable form. Students will also learn how to analyze this data using techniques from natural language processing and machine learning, including the newest innovations in relying on deep learning models.

MGT 6311 – Digital Marketing (Business Analytics Track Elective)

Digital Marketing has evolved from traditional marketing channels (radio, print, television, etc.) to include the online/internet channel and has grown significantly over the past ten years. The pace of new technology development and the ways consumers are interacting with various technologies has also been growing rapidly. Marketing executives are faced with new challenges to determine creative, cost-effective ways to create brand awareness, engage their audience, and establish strong brand reputations. Social media and mobile have established new positions in the marketing arsenal alongside more mature online components such as email and search advertising. Assembling the right mix of tactics to support an organization's overarching marketing strategy while also maximizing efforts through integrated marketing communications poses great opportunities and challenges for large and small businesses alike.

Understanding the various components of the online marketing channel at a high level is a necessary prerequisite for leveraging these tactics effectively in an applied environment. This course will explore elements including:

- Digital marketing strategy
- Online brand building/storytelling
- Social media marketing
- Online lead generation
- Mobile marketing
- Digital thought leadership

In addition to providing exposure to the tactical components of the online marketing channel, this course will also impart practical knowledge through real-world case examples and presentations from industry practitioners. Much like the field of digital marketing, this course is intended to be interactive with a healthy level of class participation and Q&A.

PUBP 6725 - Information Security Policies (Business Analytics Track Elective) (Course Preview)

This course introduces students to the policy and management aspects of cybersecurity. It is divided into four modules. The first involves basic concepts and definitions regarding policy, governance, and threats; the second deals with cybersecurity management and policy at the organizational level; the third deals with cybersecurity public policy at the national level; the fourth deals with cyber conflict, policy and diplomacy at the transnational level. This course situates cybersecurity in the overall internet ecosystem.