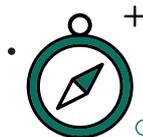


# MSHA Three-Semester Course Plan



## PREPROGRAM FOUNDATIONS REQUIREMENTS

Preparatory work begins in July/August, is in addition to required credits, and does not affect GPA.

DAT 500V: Introduction to R Programming *.5 credit*

FALL 1 REQUIRED COURSES		SPRING REQUIRED COURSES		FALL 2 REQUIRED COURSES
<p><b>REQUIRED CREDITS: 15</b></p> <p><b>Core:</b>                      MGT 560F: Professional Business Communication <i>1.5 credits</i>                      DAT 500S: Predictive Analytics for Business Decision-Making <i>3 credits</i>                      DAT 561: Introduction to Python &amp; Data Science <i>3 credits</i></p> <p><b>Track:</b>                      MGT 563: Olin Grand Rounds: The Business &amp; Practice of Medicine <i>3 credits</i></p> <p><b>Fall A</b>                      DAT 560G: Database Design &amp; SQL <i>1.5 credits</i></p> <p><b>Fall B</b>                      DAT 500N: Prescriptive Analytics <i>1.5 credits</i>                      DAT 560M: Big Data &amp; Cloud Computing <i>1.5 credits</i></p>		<p><b>REQUIRED CREDITS: 12</b></p> <p><b>Core:</b>                      DAT 500W: A/B Testing for Business &amp; Social Science <i>3 credits</i></p> <p><b>Track:</b>                      MGT 565: Healthcare Management <i>3 credits</i>                      MGT 566: Research in Healthcare Management <i>3 credits</i></p> <p><b>Spring A</b>                      (Empty)</p> <p><b>Spring B</b>                      DAT 560E: Data Visualization <i>1.5 credits</i>                      DAT 562: Text Mining <i>1.5 credits</i></p>		<p><b>REQUIRED CREDITS: 3</b></p> <p><b>Track:</b>                      MGT 564: Health Economics &amp; Policy <i>3 credits</i></p>
FALL OR SPRING RECOMMENDED ELECTIVE COURSES				EXPERIENTIAL LEARNING REQUIREMENT
<p><b>ELECTIVE CREDITS: 6+</b></p> <p>DAT 565E: Deep Learning for Prediction of Business Outcomes <i>1.5 credits*</i>                      INFO 558: Applications of Deep Neural Networks <i>3 credits*</i></p> <p>FIN 534: Advanced Corporate Finance I <i>1.5 credits*</i>                      MPH 5002: Epidemiology <i>3 credits</i>                      CSE 501N: Intro to Computer Science <i>3 credits*</i></p>				<p><b>COMPLETE 1 COURSE:</b>                      MGT 501T: Taylor Community Consulting Project <i>3 credits</i>                      MGT 551E: Internship, Business, &amp; Application <i>1.5 credits</i>                      MGT 501P: CEL Practicum <i>3 credits</i>                      MGT 501V: Applied Problem Solving for Orgs <i>1.5 credits</i></p> <p>* Elective courses offered either in Fall or Spring semesters</p>
<b>TOTAL CREDITS: 39</b>		MSA Common Core: <i>18</i>	MSHA Track: <i>15</i>	Elective: <i>6</i>

**Academic Year 2021-2022** The degree requirements in this document apply to students entering Washington University during the 2021–2022 academic year.

Under the flat tuition rate, students may take up to 18 credits per semester. Additional credits must be approved and are charged at the per credit rate. Every effort is made to ensure that the information is accurate and correct as of the date of publication (5/7/21). Washington University reserves the right to make changes at any time without prior notice. Therefore, this curriculum document may change from time to time without notice. The governing document at any given time is the then-current version, as published online.



# MSA – Healthcare Analytics Course Descriptions

## Summer Foundations Workshop

### DAT 500V Introduction to R Programming

R has become the tool of choice for many data science and customer analytics professionals in every industry and field. It is not surprising to see a requirement for being familiar with R in job descriptions. R is very flexible in carry out data analysis. Part of the benefit of being open source is that many programmers/researchers are constantly introducing new statistical analysis tools into R through R packages. Given all the benefits, R does have a relatively steeper learning curve. To better prepare MSCA students, we introduce this 2 day introduction to R programming course. This class will help you master the basics of R. We will start from the very beginning - installation of the program. No prior knowledge in programming is required. Through in class demonstration and lots of hands-on practice, by the end of the second day, you will have the chance to undertake your own data analysis and solve relevant business problems using R. 0.5 Credits. Graded Pass/Fail.

## Common Core Courses

### DAT 560G Database Design and SQL

Databases are at the foundation of every organization's information strategy. Understanding the structure of databases and mastering the tools to analyze data are essential skills in any role. The tools developed in this course assist students in implementing a company's data management strategy and developing well-grounded analytical recommendations. In this course, we focus on understanding how data is structured in relational databases. With vast amounts of data available, from disparate sources, effective organization of the data is essential to its utilization. To complement this, we utilize SQL (Structured Query Language) as the primary tool to extract data for managerial reports and for advanced analytical models. Practical experience with current relational database software is developed throughout the course. 1.5 credits.

### DAT 500N Prescriptive Analytics

This course covers optimization models and tools as they apply to the design and analysis of supply chains. Production planning, distribution, network design, and revenue management problems are covered using the methods of linear, non-linear, and integer programming. Upon successful completion of this course, students will demonstrate competency in formulating and solving supply chain optimization models of real-life complexity using state-of-the-art software. They will become proficient with industrial strength software tools like AMPL and Gurobi alongside Excel's Solver. The course emphasizes proficiency in model-building and using software tools rather than theory. 1.5 credits

### DAT 560M Big Data and Cloud Computing

The growth in available data is a challenge to many companies. This presents an opportunity for companies to conquer the vast and various data available to them. The growth in data includes traditional structured data, as well as unstructured data created by both people and machines. It is essential for analysts to be comfortable in the new technologies and tools that are being developed to store, retrieve, analyze, and report, using the vast data resources available. This course introduces students to the technologies currently deployed to overcome the challenges of Big Data. Prerequisite: MGT 560G. 1.5 credits.

### MGT 560F Professional Business Communication

Communication is the process of sending and receiving messages, however, communication is effective only when the message is understood and when it stimulates action or encourages the receiver to think in a new way. This course will introduce students to fundamental best practices in business writing and business speaking that will ensure effective communication. Students will participate in activities that will develop professional business communication skills in both writing and speaking. These will include: preparing, writing and delivering presentations, composing clear concise business messages in a variety of formats, understanding emotional intelligence to reach the audience and utilizing critical thinking as a basis for communication strategies. 1.5 credits.

### DAT 500S Machine Learning Tools for Prediction of Business Outcomes

Predictive Analytics deals with the employment of formal learning from business experience, using business data, to predict the future behavior of customers or other critical organizational elements in order to drive better business decisions. This course emphasizes data situations that students are likely to face in marketing, finance, manufacturing and consulting jobs. Students will analyze real-world business datasets using various advanced analytic techniques such as logistic regression, decision trees, neural networks, stochastic gradient boosting, MARSplines, Ensembles, Clustering,

Associations etc. The focus of the course lies in the conversion of raw and messy business data in to robust actionable predictions for decision-making. 3 credits.

### **DAT 561 Introduction to Python and Data Science**

This course provides students the necessary skill set to extract reliable insights from large datasets prevalent in various business applications, such as supply chain management, marketplace operations, healthcare analytics and financial engineering, using Python. In this course, students will develop basic tools to understand Python programs and implement data processing pipelines using Python. In particular, students will learn how to acquire, clean, analyze and visualize data in Python, which they will then use to improve decision-making processes. Throughout the course, students will use the Python programming language, which is very effective for data manipulation, reporting, and complex optimization. Topics covered include introduction to Python programming, data acquisition and cleaning, data manipulation, current multi-source data collection technology used in practice, basic data visualization using Matplotlib, ggplot2 and Bokeh. 3 credits.

### **DAT 560E Data Visualization for Business Insights**

Data Visualization has become a core skill set to derive business insights in the data rich business world. Organizations are expecting Business Analysts and Managers to create and disseminate insightful visualizations about the business. This course teaches students the necessary skill set to create insightful visualizations using Tableau to understand patterns prevalent in large datasets which are otherwise difficult to comprehend. In particular, students will learn how to choose and create appropriate visualization based on the following three criteria: 1. Who's the audience looking at the visualization? 2. What is the nature of the business goal (Descriptive, Predictive, or Prescriptive)? 3. What is the data (Categorical, Numerical, Time Series, etc.)? The course will expose students to prevalent business applications of data visualization in different domains (Customer Analytics, Supply Chain Analytics, Healthcare Analytics, Financial Technology Analytics, Accounting Analytics, Talent Analytics etc.). Upon completing this course, students will know how to create insightful dashboards and other visualizations for different audiences from the given data according to the specified goal. 1.5 credits.

### **DAT 562 Text Mining**

Consumers and companies constantly generate large amounts of unstructured or lightly structured texts on the web and offline: exchanges of consumer opinions on products and services on social media, transcripts of phone conversations with customer representatives, open-ended surveys, etc. By employing text analytics, businesses can derive at scale valuable insights into consumer attitudes to brands, competitive landscape, and customer relationships, among other applications. This course introduces students to the methods of mining, organizing, summarizing, and analyzing textual data with the objective of driving business decision-making. 1.5 credits.

### **DAT 500W A/B Testing in Business and Social Science**

This course introduces students to causal methods that are used to measure the impact of business and policy decisions. The key insight of the course is that correlation does not imply causation and therefore cannot measure impact. In this class, we will learn about A/B testing and other causal methods, as well as how to implement them in business, economic, and policy situations. 3 credits.

## **Track Required Courses**

### **MGT 563 Olin Grand Rounds**

Grand rounds in medical schools are a forum for presenting new and challenging clinical problems and cases. The goal of Olin Grand Rounds is to focus on the challenges and solutions facing the business of medicine. The course will therefore provide an introduction to the current issues facing the health care sector that integrates management tools and clinical knowledge. The objective is to provide students new insights into how modern management tools can be combined with scientific and clinical knowledge to manage health care organizations more efficiently and practice medicine more effectively. 3 credits.

### **MGT 565 Healthcare Management**

The goal of the course is to develop facility in applying basic tenets of general management to actual situations and dilemmas that might be faced by health care managers, consultants, financiers, investors, innovators, or providers in the course of their work. Issues addressed will include but not be limited to financial issues, management challenges, and conduct of operations. The first phase will cover the basic background on the structure and financing of the healthcare industry to include very brief reviews of critical topics like insurance and government-provided healthcare. A few basic frameworks will then be developed for students to apply to course topics moving forward, such as cost/benefit analysis and evaluation of risk. The remainder of the course will involve critical analyses of healthcare cases involving varied subjects and management challenges. 3 credits.

### **MGT 566 Research in Healthcare Management**

This is the capstone course for the Health Management major where students learn to apply rigorous statistical and analytical approaches to research questions in health services, but not limited to questions relating to management, finance and economics, operations, and policy. Faculty will identify several available research project options, and present these options in class. The goal is to capitalize on the strength of the university medical school and affiliated medical centers, in addition to capitalizing on existing relationships between Olin and healthcare firms to identify the student research projects. Students will also be encouraged to formulate their own research question and to identify potential data sources they could use to address these questions, if they so desire. Students will work in teams of 3-4, using the approach developed for the Practicum and Hatchery courses. 3 credits.

### **Required Experiential Course (1.5-3 credits)**

### **MEC 564 Health Economics and Policy**

The basic tenets of health economics will be covered. This course will place a unique emphasis on incorporating materials from three broad source categories: textbook elements, "lay" press and media, and academic journal publications with the aim to foster application of rigorous, critical thought to media presentations of health care economics and policy issues. 3 credits.

## **Electives**

### **MGT XXX The Business of Biology (3 credits)**

### **DAT 560N Introduction to Cybersecurity**

This course covers a broad range of cyber security terms, definitions, perspectives, concepts, and current trends with a focus on managing risk and the use of information and cyber security as business enablers. Students will complete a cybersecurity analytics-related project as part of the coursework. 1.5 credits.

### **DAT 565E Deep Learning for Business Analytics**

Deep Learning has become a core skillset to solve business problems in the unstructured, data-rich business world. Experts estimate approximately that 90% of the data in organizations is unstructured datasets (including images, texts, customer reviews, videos, etc.). Organizations would like to use these datasets to improve their business. Moreover, deep learning has a significant advantage over other machine learning algorithms, in that it does not require extracting "features" manually, prior to applying algorithms. Leading-edge organizations are also expecting business analysts and managers to be familiar with applying deep learning models to solve business problems using unstructured data. This course is a 1.5-credit required course offered to MS-Business Analytics (MSA) students in all tracks. The course will teach students to build deep learning models for solving business problems using python libraries (e.g., Keras, Tensorflow, etc.). We will cover a range of algorithms from neural networks foundations, to convolutional and recurrent network structures. These will be applied in domains such as marketing, customer behavior, and predicting finance risks. In the course, students will learn deep learning practically based on the following five questions: 1. How to visualize and analyze unstructured datasets? 2. What are neural networks and how to optimize them? 3. What is the deep learning model and how to use it in business? 4. Which deep learning structure should be used for a given business problem? 5. How to develop a deep learning model to solve business problems? In summary, the course will expose students to prevalent business applications of deep learning in different domains (Customer Analytics, Supply Chain Analytics, Healthcare Analytics, Financial Technology Analytics, Accounting Analytics, Talent Analytics, etc.). Upon completing this course, students will know how to build and optimize deep learning models for different business applications. 1.5 credits.

### **M19 PHS 501 Introduction to Epidemiology**

This course introduces the basic principles and methods of epidemiology, with an emphasis on critical thinking, analytic skills, and application to clinical practice. Topics include outcome measures, methods of adjustment, surveillance, quantitative study designs, and sources of data. Designed for those with a clinical background, the course will provide tools for critically evaluating the literature and skills to practice evidence-based medicine. Course activities: lectures, Midterm and final exams, class participation, problem sets, and papers. 3 credits.

### **M19 PHS 502 Intermediate Epidemiology**

The second course in the Epidemiology series, this course builds upon the basic principles and methods of epidemiology and introduces additional tools and concepts that are critical to a comprehensive study design. Topics include risk and association, sampling strategies, interaction, confounding, adjustment, lifetables, applied causal inference, validity and reliability, social epidemiology, and approaches to data analysis. Upon exiting this course, students will be prepared to approach the study design portion of a protocol, as required by the final course in the Epidemiology series. Course activities: lectures, Midterm and final exams, class participation, problem sets, and papers. SAS software is required for this course. 3 credits.

**M21 MSB 550 Introduction to Bioinformatics**

Provide a broad exposure to the basic concepts, methodology and application of bioinformatics to solve biological problems. Specifically, the students will learn the basics of online genomic/protein databases and database mining tools, and acquire understanding of mathematical algorithms in genome sequence analysis (alignment analysis, gene finding/predicting), gene expression microarray (genechip) analysis, and of the impact of recent developments in the protein microarray technology. 3 credits.

**S55 MPH 4003 Global Burden of Disease: Methods and Applications [Division of Public Health]**

This 3 credit transdisciplinary course provides an overview of the quantitative and qualitative methods and their applications for studying the global burden of diseases. The topics cover infectious diseases, non-communicable chronic medical illness and behavioral disorders. At the end of this course, students will have learned basic methods used for global health research and major trends in global burden of diseases; they will be able to apply the knowledge of measurements to forecast the future of the global burden of specific diseases of interest to develop needed policy recommendations. Students will be able to address prevention and intervention strategies targeted to specific nations or regions using a transdisciplinary approach. Students will have learned major dimensions of sociocultural and economic factors that affect global and regional distributions of major disease categories and how they are linked to global trade and economy in some instances. The transdisciplinary knowledge and hands-on skills learned from this course will assist students with an interest in international research to select a disease or underlying condition with a significant burden on the population of diverse nations or regions. Students will acquire practical skills that can be used in the health professions, including cultural competency training as it applies to medicine and public health. 3 credits.

**S55 MPH 5002 Epidemiology**

The purpose of this course is to present fundamentals of Epidemiology as a framework for using evidence-based approaches in addressing population health issues. Students will learn the role of epidemiological approaches for describing and quantifying health problems, and methodological approaches for assessing risk factors and disease etiology. 3 credits.