## List of Courses by Semester

### Foundations Courses
These courses are over and above the 39 required credits.

- **MKT 500R**: Fundamentals of Statistics and SPSS Programming (0.5) (Credits count toward Fall Semester)
- **MKT 500V**: R Programming (0.5) (Credits count toward Fall Semester)

### Fall Semester (15 credits, 16 with Foundation Courses)

<table>
<thead>
<tr>
<th>Fall A</th>
<th>Fall B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required:</td>
<td>Required:</td>
</tr>
<tr>
<td>MGT 560G: Database Design &amp; SQL (1.5)</td>
<td>MKT 555A: Data Analysis for Brand Management (1.5) *</td>
</tr>
<tr>
<td>MKT 571A: Marketing Research — 1 (1.5)</td>
<td>MKT 571B: Advanced Marketing Research (1.5) *</td>
</tr>
<tr>
<td>Required:</td>
<td></td>
</tr>
<tr>
<td>MKT 577: Marketing Strategy (3)</td>
<td></td>
</tr>
<tr>
<td>MKT 500S: Predictive Analytics for Business Decision-Making (3)</td>
<td></td>
</tr>
<tr>
<td>Possible Elective:</td>
<td></td>
</tr>
<tr>
<td>MKT 558: Pricing Strategy (1.5)</td>
<td></td>
</tr>
<tr>
<td>MKT 558B: Pricing Decision and Implementation (1.5)</td>
<td></td>
</tr>
</tbody>
</table>

### Spring Semester (16.5 credits)

<table>
<thead>
<tr>
<th>Spring A</th>
<th>Spring B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required:</td>
<td>Required:</td>
</tr>
<tr>
<td>MKT 500U: Digital Marketing (1.5)</td>
<td>MKT 555: Analytics-Driven Brand Management (1.5)</td>
</tr>
<tr>
<td>Possible Elective:</td>
<td>Possible Elective:</td>
</tr>
<tr>
<td>MKT 558: Pricing Strategy (1.5)</td>
<td>MKT 558B: Pricing Decision Making &amp; Implementation (1.5)</td>
</tr>
<tr>
<td>Required:</td>
<td></td>
</tr>
<tr>
<td>MKT 500T: Customer Analytics Using Probability Models (3)</td>
<td></td>
</tr>
<tr>
<td>MGT 560F: Professional Business Communications (1.5)</td>
<td></td>
</tr>
<tr>
<td>Math 420: Experimental Design (3)</td>
<td></td>
</tr>
<tr>
<td>Possible Electives:</td>
<td></td>
</tr>
<tr>
<td>CSE 131: Computer Science I (3)</td>
<td></td>
</tr>
</tbody>
</table>

### Fall 2019 (7.5 credits)

| Required:                                     |
| MKT 500Q: Intensive Industry Project (3)     |
| OMM 5705: Quantitative Decision Making (1.5)  |
| Possible Elective:                            |
| MEC 537: Data Analysis, Forecasting and Risk Analysis (3) | |

Total: 39 Credits (28.5 required credits and 10.5 elective credits from the list below)
MATH475: Statistical Computation (3)
MEC 537: Data Analysis, Forecasting and Risk Analysis (3)
MGT 620: Empirical Methods in Business (3)
MKT 558: Pricing Strategy (1.5)
MKT 558B: Pricing Decision and Implementation (1.5)
CSE 131: Computer Science I (3)
CSE 241: Algorithms and Data Structure (3)
CSE 316A: Social Network Analysis (3)
CSE 330S: Rapid Prototype Development and Creative Programming (3)
CSE 417t: Introduction to Machine Learning (3)
CSE 427: Cloud Computing with Big Data Applications (3)
CSE 514A: Data Mining (3)
CSE 517A: Machine Learning (3) (or CSE 417A)
CSE 502N: Fundamentals of Computer Science I (3)
CSE 557A: Information Visualization (3)

**Note:** Only 12 hours of approved CSE courses may count toward degree requirements.

**Note to International students:** Additional English courses may be required or waived upon arrival. If taken, these courses are over and above required credits, are graded on a pass/fail basis, and do not count towards a student's GPA calculation.

Students may take up to 19.5 credits of business coursework in the fall and spring semesters under the flat tuition rate.

The degree requirements and policies in this document apply to MSCA students entering Washington University during the 2018-19 academic year. Every effort is made to ensure that the information is accurate and correct as of the date of publication (9/19/17). 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.
Master of Science Customer Analytics (MSCA) Course Descriptions
Sept 2017 (subject to change)

Foundations Courses

MKT 500R: Fundamentals of Statistics and SPSS Programming

This foundational course, which is a required course for students in the MSCA program, will cover material that serves as useful preparation for courses offered in the Olin curriculum that rely extensively on applied statistical concepts (e.g., marketing research, advanced marketing research, database marketing, data analysis for brand management etc.). The course will provide students with both an overview of basic statistical concepts and a practical grasp of statistical analysis. Students will be trained to use SPSS, a popular statistical software package, in order to perform the statistical analysis. The course will also cover interpretation of results. .5 Credits.

MKT 500V: 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. .5 Credits

Required Courses

OMM 5705. Quantitative Decision Making

Many managerial decisions, regardless of their functional orientation, are increasingly based on analysis using quantitative models from the discipline of management science. Management science tools, techniques and concepts (e.g., data, models, and software programs) have dramatically changed the way business operates in manufacturing, service operations, marketing, finance, and other areas. This course is designed to introduce students to fundamental quantitative techniques of using data to make informed management decisions. In particular, we will focus on various ways of modeling decision problems in order to enhance decision-making skills. These objectives are facilitated through the three key management science modeling approaches taught in this course: (i) optimization tools and constrained resource allocation; (ii) decision analysis; and (iii) simulation for the analysis of uncertainty and risk. The implementation of quantitative analysis tools has been facilitated considerably by the development of spreadsheet-based software packages, and so we will make liberal use of Excel and its optimization and data analysis add-ins. 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.

MGT 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. This course is required for MS/CA students and priority will be given to SMP students. 1.5 Credits.

**MKT 555A. Data Analysis for Brand Management**

Today’s brand managers typically have access to large quantities of data. For example, managers of consumer packaged goods brands typically have access to supermarket scanner data that cover thousands of daily transactions in hundreds of product categories at the store. Careful analyses of such data lead to an improved understanding of the marketplace and, in turn, improve the quality of marketing decisions. This course will cover statistical models and techniques that can be effectively used by brand managers on large marketing datasets. While the focus will be on fast-moving packaged goods categories (coffee, laundry detergents, carbonated beverages, etc.), the course will also deal with durable goods (automobiles), entertainment products (movies), etc. Microsoft Excel will be used for analysis. 1.5 Credits.

**MKT 555. Analytics-Driven Brand Management**

This course will cover decision support tools that can be effectively used by brand managers to improve the quality of their marketing decisions, such as pricing, advertising, promotions, etc. These decision-support tools typically rely on market-based estimates of demand and competitive conditions, which are often obtained by analyzing historical transactions data (which is the focus of MKT 555A: Data Analysis for Brand Management) and sometimes using consumer surveys (which is the focus of MKT 571A: Marketing Research I). The focus of this course will be on the optimization of marketing resources and budgets given such a quantitative understanding of the marketplace. While the focus will be on fast-moving packaged goods categories (coffee, laundry detergents, carbonated beverages, etc.), the course will also deal with durable goods (automobiles), entertainment products (movies), etc. Microsoft Excel will be used for analysis. 1.5 Credits.

**MKT 577. Marketing Strategy**

Marketing strategic decisions require long-term planning and are often costly to change once implemented. They often involve more than one marketing mix variable (price, advertising and other promotions) that have to be consistent with a firm’s core competencies, with the objective of establishing sustainable competitive advantages. A good strategic planning requires careful analysis of customers and competitors in the industry, identifying a feasible set of options and deciding on a course of actions. With the development of the information technology nowadays, firms have collected valuable market data, either by themselves or from third-party data providers. The biggest question for most firms, however, is how to use these data to help make strategic decisions. The objective of this capstone course is to develop a comprehensive framework to help understand the strategic situations of firms and the trade-off involved in decision-making. It will also provide students a comprehensive knowledge of using analytical skills to solve business problems. We will explore the importance of CRM and how to use customer analysis to make marketing decisions. Other topics including competitor analysis, STP, price competition, product and entry strategies will also be covered. 3.0 credits.

**MKT 571A. Marketing Research**

This introductory marketing research course examines the role of marketing research in the formulation and solution of marketing problems. In this course, students develop and apply basic skills in conducting and evaluating marketing research design. The first part of the course will focus on data collection from consumers using techniques such as focus groups, surveys, experiments etc. The second part will focus on basic analysis of the collected data using techniques such as t-tests, chi-square, and linear regression. Students will apply and implement these techniques using standard statistical software. 1.5 Credits.

**MKT 571B. Advanced Marketing Research**

This course is a follow-up to MKT 5714 and is designed to develop advanced techniques in marketing research and analysis. In this course, students will advance their skills in conducting marketing research and analyzing data using sophisticated multivariate techniques such as conjoint analysis, multidimensional scaling, cluster analysis, etc. These analyses will give students the tools to conduct a variety of advanced marketing analyses, such as segmentation and perceptual mapping. The course will teach students how to implement these techniques using standard statistical software. 1.5 Credits.
MKT 500U. Digital Marketing

The aim of this course is to provide a rigorous and comprehensive introduction to technology and methods of conducting marketing activities online. Specific objectives are to introduce students to: (1) Concepts and terminology of digital marketing; (2) Specifics of online consumer behavior and internet-based business models; (3) Hands-on experience in creating and running advertising campaigns in social media. 1.5 Credits

MKT 500T. Customer Analytics Using Probability Models

Customer analytics is about using customer data to make business decisions and predict future behavior. This course will build and implement powerful and leading-edge models for customer acquisition, retention, behavioral patterns such as website visits, customer lifetime value and direct marketing responses. The course will provide a unifying framework for thinking about customer data analysis and develop hands-on experience in model building and estimation using Microsoft Excel. These models use basic building blocks from probability theory to offer behaviorally plausible perspectives on what people buy, when they buy, and how much they buy. Anyone with interest in the revenues generated by customers (such as managers, consultants, analysts and investors) can benefit from deeper insights and more accurate forecasts that result when accounting for these patterns in their models. 3 Credits.

MKT 500S. Predictive Analytics for Business Decision-Making

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.

MKT 500Q. Intensive Industry Project

Students will work in teams on an analytics-driven client project, applying the tools that they learned in their Fall course work to the client’s data-driven business problem under faculty and client supervision. Each student is expected to spend about 150 hours on the project. Grades are based on the quality of the final deliverables, i.e., written report and oral presentation. 3 Credits.

Electives

MKT 558. Pricing Strategies

This course is designed to equip you with some essential concepts and techniques needed to make profitable decisions about one of the most important marketing variables—price. This course is structured around four fundamental factors that firms need to consider in their pricing decisions: costs, customers, competitors, and climate (legal environment). Through case studies, in-class discussions, and course project/presentations, this course will provide you with a conceptual framework, grounded in modern economics and consumer psychology, for analyzing a complex marketing environment and designing proactive pricing strategies that are most profitable for a business. 1.5 Credits.

MKT 558B. Pricing Decision Making & Implementation

The focus of this course is on pricing tactics and strategies that are proven to be profitable for firms. Through case studies, lectures, a pricing simulation game, and presentations, this course will help students gain insights in to successful pricing strategies in various industries and to develop skills that are necessary to make the most important business decision—pricing—in their organizations. Topics of discussion include pricing innovative products, pricing and market making on the internet, pricing of digital products, and dynamic and competitive pricing. 1.5 Credits.
CSE 131. Computer Science 1

An introduction to software concepts and implementation, emphasizing problem solving through abstraction and decomposition. Introduces processes and algorithms, procedural abstraction, data abstraction, encapsulation, and object-oriented programming. Recursion, iteration, and simple data structures are covered. Concepts and skills are mastered through programming projects, many of which employ graphics to enhance conceptual understanding. Java, an object-oriented programming language, is the vehicle of exploration. Active-learning sessions are conducted in a studio setting in which students interact with each other and the professor to solve problems collaboratively. Prerequisites: Comfort with algebra and geometry at the high school level is assumed. Patience, good planning, and organization will promote success. This course assumes no prior experience with programming. 3 Credits.

CSE 247 Data Structures and Algorithms

Study of fundamental algorithms, data structures, and their effective use in a variety of applications. Emphasizes importance of data structure choice and implementation for obtaining the most efficient algorithm for solving a given problem. A key component of this course is worst-case asymptotic analysis, which provides a quick and simple method for determining the scalability and effectiveness of an algorithm. 3 Credits.

CSE 330S. Rapid Prototype Development and Creative Programming

This course uses web development as a vehicle for developing skills in rapid prototyping. Students acquire the skills to build a Linux web server in Apache, to write a web site from scratch in PHP, to run an SQL database, to perform scripting in Python, to employ the Django web framework, and to develop modern web applications in client-side and server-side JavaScrip. The course culminates with a creative project in which students are able to synthesize the course material into a project of their own interest. The course implements an interactive studio format: after a formal presentation of a topic, students develop a related project under the supervision of the instructor. 3 Credits.

CSE 417T. Introduction to Machine Learning

This course is a broad introduction to machine learning, covering supervised learning, unsupervised learning, decision-making under uncertainty, and reinforcement learning. Topics that will be covered include generative and discriminative techniques for classification (likely including regression, Naive Bayes, decision trees, neural networks, nearest-neighbor methods, support vector machines, and boosting), clustering and dimensionality reduction, dynamic programming, and temporal difference methods. Note that there is some overlap with topics in the 500-level courses on Artificial Intelligence and Machine Learning, but the material covered in this class will be at a more elementary level. 3 Credits.

CSE 427S. Cloud Computing with Big Data Applications

This course provides a comprehensive introduction to applied parallel computing using the MapReduce programming model facilitating large scale data management and processing. There will be an emphasis on hands-on experience working with the Hadoop architecture, an open-source software framework written in Java for distributed storage and processing of very large data sets on computer clusters. Further, we will make use of related big data technologies from the Hadoop ecosystem of tools, such as Hive, Impala, and Pig in developing analytics and solving problems faced by enterprises today. 3 Credits.

CSE 502N. Fundamentals of Computer Science

Study of fundamental algorithms, data structures, and their effective use in a variety of applications. Emphasizes importance of data structure choice and implementation for obtaining the most efficient algorithm for solving a given problem. A key component of this course is worst-case asymptotic analysis, which provides a quick and simple method for determining the scalability and effectiveness of an algorithm. 3 Credits.

CSE 514A. Data Mining

Many scientific computing problems are, by nature, statistical. Such problems appear in many domains, such as text analysis, data mining on the web, etc. Another source of the statistical nature of such problems is the lack of sufficient information of the problem domains as well as the specific problems at hand. What is available for a typical application is usually a set of data from observation. The main objective of this course is to gain experience of dealing with statistical data analysis problems by studying various statistical methods that can be used to make sense out of data, by reading and reviewing literature as well as by working on a specific problem in a selected application domain. 3 Credits.
CSE 517A. Machine Learning

This course assumes a basic understanding of machine learning and covers advanced topics at the frontier of the field in-depth. Topics to be covered include kernel methods (support vector machines, Gaussian processes), neural networks (deep learning), and unsupervised learning. Depending on developments in the field, the course will also cover some advanced topics, which may include learning from structured data, active learning, and practical machine learning (feature selection, dimensionality reduction). 3 Credits.

CSE 557A. Information Visualization

We are in an era where it is possible to have all of the world’s information at our fingertips. However, the more information we can access, the more difficult it is to obtain a holistic view of the data or to determine what’s important to make decisions. Computer based visualization systems provide the opportunity to represent large and/or complex data visually to aid comprehension and cognition. In this course, we study the principles for transforming abstract data into effective information visualizations. We learn about the state-of-the-art in visualization research and development, and we gain hands-on experience with designing and developing information visualizations. We also learn how to critique existing visualizations and how to evaluate the systems we build. Readings will include current research papers from the Information Visualization community. 3 Credits.

MEC 537. Data Analysis, Forecasting and Risk Analysis

This course presents a modem and contemporary coverage of several econometric models that are used for the analysis and forecasting of business data. The basic building blocks for the analysis are regression time series models. Broad coverage of non-seasonal and seasonal ARIMA models is included. The important family of ARCH-GARCH models, used to represent changing volatility, are also covered in detail. These models are widely used in option pricing and in other financial applications. The course includes some extensions of these models to multivariable problems. Students are exposed to numerous real data sets in class and in assignments. All the models are analyzed with a popular econometrics software package that is employed in business. A group project is required. 3 Credits

Math 475. Statistical Computation

Applied statistics using SAS. An introduction to SAS and SAS programming; contingency tables and Mantel-Haenszel tests; general linear models and matrix operations; simple, multilinear, and stepwise regressions; ANOVAs with nested and crossed interactions; ANOVAs and regressions with vector-valued data (MANOVAs). Topics chosen from discriminant analysis, principal components analysis, logistic regression, survival analysis, and generalized linear models. Prior acquaintance with SAS at the level introduced in Math 3200 is assumed. 3 Credits.