Course Information:

Name:	EMSE 6035: Marketing of Technology
Semester:	Spring 2019
Meeting Time:	Wednesdays, 06:10pm - 08:40pm
Location:	Tompkins 402

Instructor Information:

Name:	John Paul Helveston
Campus Address:	Science & Engineering Hall, Office 2830
Phone:	+1 (202) 994-7173
Email:	jph@gwu.edu
Office Hours:	[TBD]

1. Course Description

1.1 GW Bulletin Description

Analyzing data to inform design decisions in an uncertain, competitive market; topics include consumer choice modeling, programming in *R*, survey design, conjoint analysis, optimization, market simulation, and professional communication skills.

1.2 Detailed Description

This course provides students with data analysis techniques to inform design decisions in an uncertain, competitive market. Over the course of the semester, students will learn and apply theory and methods to a team project to assess the market competitiveness of an emerging product / technology and use marketing analytics to generate design insights.

This course has a "flipped" classroom structure. Students will spend the majority of class time working through guiding practice exercises or working on their projects. To prepare for class, students must complete "Pre-Class Assignments" (PCAs), which involve watching and reviewing recorded lecture materials and answering related practice questions. At the start of each class, we will review the PCA and go through the solutions to the practice questions. Students will complete a self-assessment of their answers. Working through the PCAs on schedule and participating in the self-assessments will be crucial to success in the course.

1.3 Prerequisites

This course requires prior exposure to probability theory, multivariable calculus, linear algebra, and regression. Each of these concepts will be applied throughout the course, and no time will be spent reviewing the foundational elements of each concept. To self-assess familiarity with these concepts, students can take this three-question self-assessment quiz. It shouldn't take more than 10-20 minutes to complete, and answers can be compared with the solutions. Students that have trouble answering these questions may find this course challenging and may want to take other courses or review refresher materials on these topics prior to taking EMSE 6035. In addition, we will work in the *R* programming language throughout the course, but no prior programming experience is required. We will spend the first two weeks going through exercises to get up to speed in *R*.

1.4 Learning Outcomes

Having successfully completed this course, students will be able to do the following:

- Wrangle and summarize data in *R*.
- Design surveys to obtain informative data about consumer preferences for product features.
- Build and estimate discrete choice models.
- Analyze consumer choice data to estimate consumer preferences for product features.
- Design and create effective charts and presentations.
- Communicate results in terms of design insights.

2. Required Texts & Materials

We will use a computer in almost every class period to complete exercises and work on team projects. Students are encouraged to bring their own laptops to class.

2.1 *R*

We will use *R* starting day one! *R* is a powerful open-source software for statistics and data analytics. Students must download and install both *R* (the programming language) and *RStudio* (a nice environment within which to organize and conduct analyses). Use these links:

- R: https://cran.r-project.org/R
- RStudio Desktop (free version): https://www.rstudio.com/products/rstudio/download/

2.2 Data Camp

Some assignments will be on datacamp.com. Data Camp is an online instructional platform for learning data science skills. Data Camp assignments include both instructional videos (which can be repeated and sped-up) and practice sessions. **Students must join the course group** on Data Camp, after which access will be granted to all of Data Camp's courses and resources for six months.

2.3 Supplementary Materials

These textbooks are available for free and are helpful as optional reading:

- Michalek, J. (2016) Quantitative Entrepreneurship: Analysis for New Technology Commercialization [Draft]. Available on Blackboard.
- Train, K. (2009) Discrete Choice Methods with Simulation, Cambridge University Press. Available for free online as a pdf at http://elsa.berkeley.edu/books/choice2.html.

You will inevitably run into problems while learning *R*. The best starting point for troubleshooting is Google. In addition, these resources can also be helpful:

- R for Data Science (ISBN 978-1491910399), by Wickham and Grolemund. Available for purchase on Amazon, or free online at http://r4ds.had.co.nz/.
- For Excel users, Andrew Ba Tran's Tutorial on switching from Excel to R can be helpful: https://trendct.org/2015/06/12/r-for-beginners-how-to-transition-from-excel-to-r/
- Reference guide for the ggplot2 package: https://ggplot2.tidyverse.org/reference/index.html.
- A helpful guide for plotting using the ggplot2 package: http://www.cookbook-r.com/Graphs/.

3. Class Schedule

Students will be responsible for completing each PCA prior to the corresponding class according to the schedule. The instructor reserves the right to change the syllabus, including the schedule, at any time and for any reason; in such circumstances, the instructor will provide sufficient advance notice as it relates to assignment and project deadlines.

Week	Date	PCA Due	Project Due	In-Class Topics	In-Class Project
1	01/16			Course overview; intro to R	Project and classmate introductions
2	01/23	1-DataCamp: Intro to R		Managing and wrangling data in R	Decision variables; product attributes; relationships table; teams formed
3	01/30	2-DataCamp: The tidyverse		Chart design; plotting with ggplot2	Project proposals; teams finalized
4	02/06		Team Report: Proposal	Intro to choice data	Team Presentation: Proposal
5	02/13	3-Concept: Intro to choice modeling	Team member peer feedback	Random utility models; logit, probit, IIA; partworth vs. linear	Survey plan: define attributes & levels, target survey respondents
6	02/20		Survey Plan	No Class: SEAS Student R&D Showcase (optional review period)	
7	02/27	4-Concept: MLE & optimization		MLE, optimization	Survey design in Qualtrics
8	03/06	5-DataCamp: Choice modeling in R	Pilot survey	Partworth vs. linear models; outside good; WTP	Field pilot surveys
9	03/13			No Class: Spring Break	
10	03/20	6-Concept: Uncertainty & DOE	Pilot survey data	Uncertainty; design of experiment (DOE)	In-class workshop: analyzing pilot results
11	03/27		Team Report: Pilot results	Exam review	Team Presentation: Pilot results
12	04/03		Team member peer feedback	Exam	Final survey revisions
13	04/10	7-Concept: WTP & Simulation	Final survey	WTP & Market simulation	Market simulations; begin fielding final surveys
14	04/17	8-Concept: Heterogeneity		Heterogeneity: interactions, mixed logit	Analyze final survey data to-date
15	04/24		Team Report: Final		Final presentation dry runs
	Finals:				Team Presentations: Final

NOTE: In accordance with university policy, the final exam will be given during the final exam period and not the last week of the semester.

4. Assignments and Grades

4.1 Pre-Class Assignments (PCAs)

Students will complete Pre-Class Assignments (PCAs) outside of class to prepare for **new** material that will be covered / practiced in the next lecture. Each PCA includes instructional videos and practice exercises. **PCAs are due by 11:59pm on the day prior to the corresponding class period on the schedule**. Students may complete PCAs ahead of schedule if desired. There are two types:

- **DataCamp**: DataCamp PCAs are oriented towards learning how to implement concepts in *R*. Assignments are listed both on Blackboard and within the course group on datacamp.com. Credit for each DataCamp assignment will be allocated in proportion to the percentage of the assignment completed by the due date. Completing other DataCamp chapters and courses outside of those assigned is encouraged for students who wish to further develop their proficiency in *R* or other programming languages.
- **Concept**: Concept assignments are oriented towards understanding core concepts. These involve watching a recorded video lecture and answering practice questions presented in the video. Students must submit a pdf of their responses to the practice questions on blackboard by the due date to receive 50% credit for the assignment. The remaining 50% will be earned by participating in a self-assessment process done at the beginning of each class, during which the instructor will go through the questions and solutions, addressing areas of confusion. In the case of a valid student absence, a self-assessment may be submitted outside of class (with a due date set according to a reasonable schedule determined on a case-by-case basis).

PCA descriptions and due dates (by 11:59pm)

PCA	Type	Description	Due Date
1	DataCamp	Introduction to R and the *dplyr* package	Jan. 22
2	DataCamp	Intro to the *tidyverse* package and plotting with the *ggplot2* package	Jan. 29
3	Concept	Introduction to choice modeling	Feb. 12
4	Concept	Maximum likelihood estimation & optimization	Feb. 26
5	DataCamp	Intro to choice modeling in R and the mlogit package	Mar. 5
6	Concept	Uncertainty and design of experiment	Mar. 19
7	Concept	Willingness to pay & market simulation	Apr. 9
8	Concept	Heterogeneity	Apr. 16

4.2 Project Assignments

This course is framed around one, team-based, semester-long project. The project will have three phases: 1) project proposal, 2) pilot survey analysis, and 3) final survey analysis. The following project assignments will be due in each phase:

- **Project presentations**: Each team will present a short summary of the work accomplished during each phase. Presentations will be during class time.
- **Project reports**: Each team will submit a written report of the work accomplished during each phase. Instructions on each report requirements will be provided.

- **Peer Feedback Between Teams**: On team presentation days, each student will be required to critique two other teams' presentations with comments and suggestions posted on Blackboard.
- **Peer Evaluation Within Teams**: Each student will be required to submit confidential peer evaluations with each project report for each member of their own team (including themselves). These reports help the instructor identify any team difficulties and miscommunications with adequate time to make adjustments as needed.

4.3 Class Participation

Regular class attendance is essential. Much of the class time will be spent doing exercises, working on team projects, and presenting results. Multiple absences, inappropriate or unprofessional behavior during class (such as monopolizing discussions or being rude or disruptive), not participating in classroom exercises, not participating in team project assignments, and not being prepared for class will result in a lower grade for the class participation component. As a rule of thumb, the participation grade will be assigned according to the following rubric:

Score	Attendance	Classroom	Teamwork
Low	Frequently absent	Rude; disruptive; distracting; monopolizes discussions	Little to no contribution to project assignments
Moderate	Attended most classes, but often arrived late or left early	Takes notes; attentive; occasionally contributes in class discussion / exercises	Contributes to only some but not all project assignment
High	Attends on time and prepared	Takes notes; attentive; regularly contributes in class discussion / exercises; does not dominate conversation; listens and responds thoughtfully to comments made by others	Contributes meaningfully to all project assignments

4.4 Grades

Students will be graded in three main areas: 1) understanding of core principles, 2) timeliness and quality of project assignments, and 3) verbal, written, and visual communication of findings. Specific grading in these areas can be approximately weighted as below, although the instructor reserves the right to make changes to better reflect the balance of work in the course.

Core Principles:	– Pre-Class Assignments (8 at 5% each)	40%
	– Exam	15%
Project:	– Proposal presentation	2%
	– Proposal report	3%
	– Pilot survey analysis presentation	4%
	– Pilot survey analysis report	6%
	– Final project presentation	8%
	– Final project report	12%
Participation:	– In-class exercises; peer feedback; attendance; professionalism	10%

5. Course Projects

Each team's course project will have three phases: 1) project proposal, 2) pilot survey analysis, and 3) final survey analysis. Teams will apply topics covered in class to develop quantitative models of consumer choice to inform design decisions. Each team will have somewhat different tasks and areas of emphasis, depending on the product selected; however, all projects will be expected to demonstrate mastery of the topics covered in class and to address the criteria and guidelines required for project assignments.

5.1 Project Selection

Students will form teams of four to five teammates and select projects during the first two weeks of class. Projects much be an emerging technology or product with a clearly identified market that has not yet been introduced into high-volume manufacturing, such as a new invention from a research laboratory at GWU or a new product being explored by a firm.

Students have the option to choose a sponsored project or propose their own project if it is approved by the instructor and meets the following criteria:

- **Innovative / Emerging**: The proposed project involves a new product or technology with attributes (e.g. price, efficiency, reliability, size, performance, color, etc.) that may be competitive in the marketplace but for which actual market adoption is still uncertain.
- **Well-Defined**: This course focuses on mathematical modeling to support design decision-making. There is not sufficient time in the course for conceptual design of a new product.
- **Identified Target Market**: A target market has been identified for this new product or technology. Competing products in that market are known, and the attributes on which new market entrants compete can be identified. Representative potential customers can be identified for survey solicitation. If the new product or technology is a component of a larger product sold to a consumer market, students may assess the market implications for the final consumer product.
- **Prior to Mass Commercialization**: The new product or technology has only recently or has not yet been introduced into high-volume manufacturing.
- **Moderate Scope and Complexity**: The product or technology should involve moderate complexity. For example, a non-differentiated commodity, such as sugar, is too simple, and a complex product involving many components and manufacturing operations, such as a vehicle, is too complex.
- **Expertise**: If the product involves a new technology that requires specialized knowledge about its attributes, the team should have reliable access to experts who can supply the requisite knowledge.
- **Decision Variables**: The product should have several non-trivial design decisions. For example, choosing between two materials or topologies, setting dimensions of a component, or selecting among a set of alternative component configurations are suitable design decisions. The models developed in the project will be used to support decision-making along such dimensions.

5.2 Teamwork

The experience of working in teams on this project will serve as preparation for teamwork throughout your careers. Some teams may experience an imbalance in team member contributions, effort, or reliability. The instructor is available to provide advice and interact in resolving team inequity and conflict; however, students should view this as a learning experience. Such situations regularly occur in any career, and learning how to handle them is a valuable skill. If you experience challenges within your team, it is a good opportunity to develop strategies and figure out how you will address such challenges in the future. One common job interview question is, "Describe a time when you experienced difficulties working in a team or experienced a team failure. What did you do about it?" This is a good chance to build a strong answer to this question.

6. Course Policies

Late Policy:

Late assignments will not be accepted. Given special circumstances (emergencies, family illness, medical issues, etc.), students should approach the instructor to discuss the situation.

Policy on Recording:

No student is permitted to record or tape any classroom activity without the consent of the instructor. If a student is disabled and needs to record or tape classroom activities, he/she should contact the Disability Support Services (DSS) to request an appropriate accommodation.

Inappropriate Use of Course Materials:

All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course.

7. University Policies

7.1 University Policy on Religious Holidays

- Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance.
- Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations.
- Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course-related activities.

7.2 Support for Students Outside the Classroom

Disability Support Services (DSS):

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: https://disabilitysupport.gwu.edu/

Mental Health Services (202-994-5300):

The University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. https://healthcenter.gwu.edu/counseling-and-psychological-services

7.3 Academic Integrity Code

Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For the remainder of the code, see: https://studentconduct.gwu.edu/code-academic-integrity

In addition to the formal code of academic integrity, the instructor expects that students will treat this course with the level of professionalism required in the workplace. Remember that real firms are sponsoring student projects throughout the semester; in a workplace setting, these firms would be paying clients for the analyses being conducted. This course prepares students to succeed in the workplace, and maintaining a high degree of professionalism is expected.