GEORGE MASON UNIVERSITY
Department of Systems Engineering and Operations Research
SYST 573 – Decision and Risk Analysis

Fall 2017 Syllabus

Contents

Instructor:

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Virtual Office Hours: By appointment via Blackboard Collaborate.
I am available Monday at 9 am to Friday at 5 pm for student inquiries. During this 5 day period, I will respond to student inquiries within 24 hours.

Course Description:

The intent of this course is to provide a modern perspective on analytical methodologies to support decision making. Decision analysis offers a set of structured procedures that assist decision-makers in structuring decision problems and developing creative decision options, quantifying their uncertainty (this includes combining available statistics with expert judgments, and their own beliefs to arrive at estimates of the probabilities of various outcomes), quantifying their preferences (this includes structuring their value tradeoffs and examining their attitude towards risk), combining their uncertainty and preferences to arrive at "good" decisions. This course provides an introductory treatment of decision analysis. The intended participants are students who want to learn more about decision making under uncertainty and tools that can be used to support it.

Credits: 3

Course Prerequisites:
STAT 346 or the equivalent, and graduate standing in an engineering program.

Course Expectations:

1. Working online requires dedication and organization. Proper preparation is expected every week. You are expected to log in to the course each week and complete the assignments and activities on or before the due dates.
2. Students must check their GMU email messages on a **daily** basis for course announcements, which may include reminders, revisions, and updates.
3. It is expected that you will familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat**,** plagiarize**,** steal**,** and/or lie in matters related to academic work.
4. It is essential to communicate any questions or problems to me promptly.

Online Learning Community:

This online course is taught via Blackboard Courses (Log into http://mymason.gmu.edu, select the Courses Tab, and the course can be found in the Course List).

This course is offered completely online. Each week begins on Tuesday and ends on Monday. Homework assignments must be submitted by Monday of the week. Tuesday, a new module will be available that will have the answers for the homework of the previous week. There is one **LIVE session on Thursday, December 4th** for the presentation of the projects using Blackboard Collaborate. **You must be at a computer with a microphone in order to present your prototype during the LIVE session.**

In our online learning community, we must be respectful of one another. Please be aware that innocent remarks can be easily misconstrued. Sarcasm and humor can be easily taken out of context. When communicating, please be positive and diplomatic. I encourage you to learn more about Netiquette.

Technology Requirements:
The technology requirements for this online course are listed below:

Hardware:
You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and to a fast, reliable broadband Internet connection (e.g., cable, DSL). For optimum visibility of course material, the recommended computer monitor and laptop screen size is 13-inches or larger. You will need computer speakers or headphones to listen to recorded content. A headset microphone is recommended for live audio sessions using course tools like Blackboard Collaborate. For the amount of computer hard disk space required to take an online course, consider and allow for the space needed to: 1) install the required and recommended software and, 2) save your course assignments.

For hardware and software purchases, visit Patriot Computers.

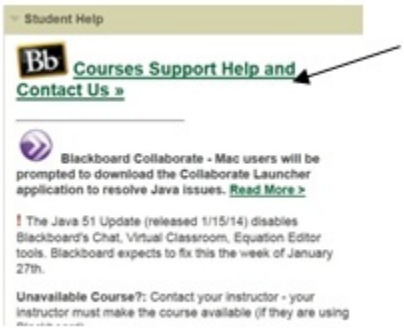
Software:
Web browser (See Blackboard Support for supported web browsers)
Blackboard Courses (Log into http://mymason.gmu.edu, select the Courses Tab)
Blackboard Collaborate (select from the course menu)
Adobe Acrobat Reader (free download)
Flash Player (free download)
Microsoft Office (purchase)

Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

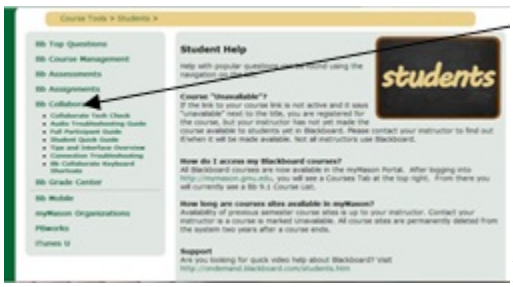
Blackboard Collaborate: The final project presentation will take place on Blackboard Collaborate, a synchronous videoconferencing platform. In addition, I will make a Collaborate Session available to each project group for their use during the semester. Login in to mymason.com with your Mason NetID and password. Select the Courses Tab. Choose the course SYST573. Click on Collaborate on the left menu. Under Blackboard Collaborate Click on the Collaborate Image to be redirect to your Collaborate 

Please make sure to update your computer and prepare yourself to begin using the online format BEFORE the first day of class. The IT Support Center can be found online here.

Navigate to the Student Support page on your MyMason page and select the Courses Tab:



Click on the link as shown in picture.



In the menu bar to the left you will find Blackboard Collaborate; you need to become familiar with Blackboard Collaborate for this course. Make sure you

run a system check a few days before videoconference day. To do this, click on Bb Collaborate and a dropdown menu will appear. Become familiar with the attributes of Collaborate and online learning.

**On project presentation day, make sure to log on at least 10 minutes before online session and check that you are set to go before class starts.

Learning Outcomes:
At the end of this course, students will be able to:

1. Organize or structure complex decision problems for analysis.
2. Identify and quantify tradeoffs between multiple objectives that a decision maker wants to accomplish.
3. Identify and quantify sources of *uncertainty and risk* in decision problems.
4. Quantitatively incorporate subjective decision maker judgments in decision problems.
5. Apply decision analysis techniques to a realistic decision problem and present the results both orally and in written form.

Required Text & Decision Analysis Software:

1. Strategic Decision Making
   Author: Craig W. Kirkwood
   ISBN-13: 978-0-534-51692-5
   Publication Date: 1997
2. Logical Decisions for Windows (student version software $65)| website|
   Analytica (free edition software) website
3. Additional Readings:
   Readings will be provided in the weekly modules.

Performance-based Assessments:

1. **Homework (10%):**
   a. **Problem sets:** There will be homework problems to be done almost every week. These problems will allow the student to practice the techniques that we learn during the class.

   b. **Affinity Diagram Exercise:** Students will form groups and perform an affinity diagramming exercise. The final product will be a value hierarchy with measures identified for each bottom row element.

2. **Tutorials (15%)**

a. **Logical Decisions for Windows Tutorial:**
Students will complete the LDW tutorial and will use the software to formulate a decision problem. The software can be downloaded from the website, but a code will be provided later to obtain the student discount. The software costs $65.

b. **Analytica Tutorial**:
Students will complete the Analytica tutorial and will use the software package to formulate and solve a given decision problem. This software is free and can be downloaded from the Lumina website.

3. **Project (25%)**
   a. **Decision Analysis Group Project**: A group project will be done by everyone in the class, and will count 25% of the course grade. The size of the groups will depend on the number of people in the class. The purpose of the project is to apply the concepts and techniques learned in this class to more realistic problems than any that could be found in a textbook. Thus the project is an important part of the course.

   The topic of your project will be up to the group. Ideally, the topic should deal with some realist decision problem. I have no problem with using problems encountered by one or more of the group members in their life outside the classroom. The analysis and solution of the problem should make use of the techniques of decision analysis that you have learned in the course, and it should apply to a decision problem that has at least 3 alternatives, at least 3 evaluation concerns, and significant uncertainty in at least one of the evaluation concerns.

   A one page proposal outlining the problem context, a preliminary list of alternatives, a preliminary list of evaluation concerns, proposed data sources, and group members is due on October 16, 2017. I will be happy to speak to groups who want to discuss potential topics.

   b. **Project Presentation**:
   The student presentations will take place in Blackboard Collaborate in a live session on Wednesday, December 6, 2017 at 7:20 pm EST. Communicate any difficulties in presenting on these dates promptly.

4. **Midterm Examination (25%)**:
   A midterm exam covering the course material up to that point will be given. The format of the exam is TBD.

5. **Final Examination (25%):**
   A final examination will be held covering course material presented after the midterm exam. The format of the exam is TBD.

Grading:
Students will be evaluated in the following areas:

Homework problem sets (10%)
Tutorials (15%)
Project (25%)
Midterm Exam (25%)
Final Exam (25%)

Rubrics:

Homework Problem Sets, Examination, and Tutorial Problems Rubric

Criteria	**Expected**	**Sufficient**	**Insufficient**	**Not Evident or Not Completed**
Timely turn-in of assignment	Turned in by close of business on Monday each week	Turned in before the homework answers are provided	Turned in after answers are posted	Not turned in at all
Problem Formulation	Problem correctly formulated	Minor errors in formulation	Major errors in formulation or major omissions in aspects of the problems	Completely incorrect formulation
Computation of results	No errors in computation	Minor arithmetic errors	Serious errors in computation	Completely incorrect answers or no work shown
Clear presentation of results	Answer to problem is clearly shown and explained	3-4 protocols adhere to	1-2 protocols adhered to	0 protocols adhered to
Points	**10**	**6-9**	**1-5**	**0**

Project Rubric

Each group's project report and presentation will be graded on a scale of 1 to 5 in the following five areas: problem definition, analytical approach, use of techniques and methods, analysis and computation, and support to decision making.
1 - very weak; 2 – weak; 3 – strong; 4 – very strong; 5 – excellent

Project Rubric			
	Analysis (15 pts)	**Report (5 pts)**	**Presentation (5 pts)**
Problem definition			
Analytical approach			
Use of techniques and methods			
Analysis and computation			
Support to decision making			
Total (25 possible points)			

Schedule:

Learning Module Topics	Readings	Videos	Assignments
Week 0 August 22-28			
Week 1 August 29-September 4 1. Introduction to decision making 2. Interacting with decision makers 3. Probability review part 1	Chapter 1 Sections 6.1-6.3	1. Class Rules Video 2. Course Introductory Video 3. Interacting with decision Makers Video 4. Probability Review Part 1	1. Introduce yourself to the class 2. Week 1: Homework Problems **Due: 9/4 11:59PM**
Week 2 September 5-11 Probability review part 2	None	1. Probability Review Part 2 Total Probability and Bayes Theorem 2. Probability Review Part 2 Random Variables and Discrete Distributions 3. Probability Review Part 2 Continuous Distributions	Week 2: Homework Problems **Due: 9/11 11:59PM**
Week 3 September 12-18 1. Probability review part 3 2. Value Focused Thinking – building a qualitative value function	Article by Keeney Chapter 2, pg 11-23	1. Conclusion of Probability Review 2. Value Focused Thinking	1. Week 3: Homework Problems 2. Week 3: Value Hierarchy Homework 3. Forming Project Teams **Due: 9/18 11:59PM**
Week 4 September 19-25 1. Affinity Diagram 2. Building a quantitative value function	Article – How to Build an Affinity Diagram	1. Building an Affinity Diagram 2. Introduction to Quantitative Value Functions	1. Affinity Diagram Group Exercise 2. Week 4: Homework Problems **Due: 9/25 11:59PM**
Week 5 September 26-October 2 Single dimensional value functions	Chapter 4, pgs. 53-68	1. Linear Single Dimensional Value Functions 2. Piecewise Linear Single Dimensional Value Functions 3. Exponential Single Dimensional Value Functions	Week 5: Homework Problems **Due: 10/2 11:59PM**
Week 6 October 3-9 1. Determining weights for the quantitative value function 2. Using the value function to prioritize alternatives	Textbook, pgs. 68-98.	1. Quantitative Value Functions –weights: Determining Weights 2. Example Problem: Example calculations for Value Function 3. Another Swing Weight Example 4. Value Hierarchy Calculations: Calculations on a Value Hierarchy 5. Value Hierarchy Calculations Example	Week 6: Homework Problems **Due: 10/9 11:59PM**

Learning Module Topics	Readings	Videos	Assignments
Week 7 October 10-16 Midterm examination			1. Midterm Examination 2. Project Proposal **Due: 10/16 11:59PM**
Week 8 October 17-23 1. Midterm exam solution 2. Weight elicitation – alternate techniques 3. Introduction to decision analysis software	LDW Users Manual	1. Alternate Methods of Weight Elicitation –Rank Based Methods 2. Alternate Methods of Weight Elicitation –Trade offs 3. Logical Decision for Windows Tutorials (Youtube)	Week 8: Homework Problems **Due: 10/23 11:59PM**
Week 9 October 24-30 1. The Analytics Hierarchy Process 2. Uncertainty in Decision Making	Pages 259-260 in the text about AHP. Chapter 5 in the text about Thinking about Uncertainty Article by Slovic regarding risk perception.	1. Analytical Hierarchy Process 2. Uncertainty Characterization 3. Example problems – Triangle and Beta Distributions	Week 9: Homework Problems **Due: 10/30 11:59PM**
Week 10 October 31-November 6 1. Decision Trees 2. Influence diagrams	Appendix D pages 321 to 326	1. Decision Trees	Week 10: Homework Problems **Due: 11/6 11:59PM**
Week 11 November 7-13 1. Building Influence Diagrams 2. Learning Analytica – Influence Diagram Software	Pages 326-329 about Influence Diagrams	1. Influence Diagrams 2. Analytica Videos	Week 11: Homework Problems **Due: 11/13 11:59PM**
Week 12 November 14-20	Chapter 9 Pages 82-86	1. Risk and Utility 2. Example – elicitation 3. Exponential Utility Functions 4. Multi-Attribute Utility Theory 5. Example – calculations 6. Sensitivity Analysis	Week 12: Homework Problems. **Due: 11/20 11:59PM**
Week 13 November 21-27			
Week 14 November 28 - December 6			Project Presentation

Student Expectations:

Academic Integrity

Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See http://academicintegrity.gmu.edu/distance].

Late Homework

Since the homework solutions will be posted on the morning after the due date, no late work will be accepted without prior coordination with the instructor.

Honor Code
Students must adhere to the guidelines of the George Mason University Honor Code [See http://oai.gmu.edu/honor-code/masons-honor-code/].

MasonLive/Email (GMU Email)
Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See https://thanatos.gmu.edu/masonlive/login].

Patriot Pass
Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See https://thanatos.gmu.edu/passwordchange/index.jsp].

University Policies
Students must follow the university policies. [See University Policies].

Diversity: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

Responsible Use of Computing
Students must follow the university policy for Responsible Use of Computing. [See http://universitypolicy.gmu.edu/1301gen.html].

University Calendar
Students must follow the university policies. [See Catalogue].

Students with Disabilities
Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu].

Students are expected to follow courteous Internet etiquette.

Student Services:

University Libraries
University Libraries provides resources for distance students. [See http://library.gmu.edu/distance].

Writing Center
The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. [See http://writingcenter.gmu.edu]. You can now sign up for an Online Writing Lab (OWL) session just like you sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment! Learn more about the Online Writing Lab (OWL) (found under Online Tutoring).

Counseling and Psychological Services
The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See http://caps.gmu.edu].

Family Educational Rights and Privacy Act (FERPA)
The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See http://registrar.gmu.edu/privacy].