FOSTER SCHOOL OF BUSINESS
UNIVERSITY OF WASHINGTON

Decision Support Models
BA 502 (QMETH)—Spring 2023

Instructor

Mark Hillier
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Class Sessions (Paccar 392): Tuesday and Thursday (March 28–April 27)
Section A: 8:45am–10:15am
Section B: 10:30am–12:00pm
Remote Office Hours (https://washington.zoom.us/j/92163374989): Mondays, 5:15–6:00pm
In-Person Office Hours (Paccar 465): Tuesdays & Thursdays, 12:15–1:00pm
Review Sessions (Paccar 392): Fridays, 10:00–10:30am (March 31, April 7 9:10-9:50am, 14, 21)
Review Session for Final Exam (Paccar 392): Friday 9:10–10:30am (April 28)
Canvas Home Page: https://canvas.uw.edu/courses/1658935

Course Description

This course introduces you to the concepts and methods of management science, which applies mathematical modeling and analysis to management problems. Our principal interest is to help you develop the skills necessary to build and evaluate models and to understand the reasoning behind model-based analysis. Spreadsheet packages now have features that allow managers to perform sophisticated quantitative analysis in the comfortable and intuitive environment of the spreadsheet.

Course Materials

Textbook: Hillier and Hillier, *Introduction to Management Science*, 7th Edition, McGraw-Hill/Irwin, 2023. This book is available at the UW Bookstore.
Course Packet: includes copies of the syllabus, class slides, problem sets, and case study. Available in paper form from E Z Copy N' Print at 4336 University Way. The paper format is recommended for ease of taking notes during class. The complete packet is also available for download in pdf format on the Canvas Home Page, or all of the elements (syllabus, class slides by session, problem sets, case) are available individually on the various Canvas pages.

Software

Microsoft Excel, including the Solver, TreePlan, and Crystal Ball add-ins (see the Canvas Home Page under Course Software for how to obtain these Excel add-ins). For Windows, Excel 2010 and later will work for this course. For the Mac, Excel's Solver is somewhat unreliable—please read the information for Mac users available on the Canvas Home Page (under Course Software). The Analytic Solver mentioned in the textbook is *not* required for this course.

Delivery Method

For most class sessions, there is some material that is best delivered asynchronously (through videos that I have recorded for you)—basically lecture material. Then there is other material that is more interactive (with discussion, demonstrations, games, or the like) that is best delivered synchronously, in our live class meeting.

Therefore, I will be dividing up most class sessions as follows:

> **Before Class:** There will typically be a video or a set of videos to watch (posted on Canvas) that must be watched *before* the live class session. The live class session will assume that *everyone* has watched these videos.
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> **Live Class Session:** On scheduled class days, we will meet in person in Paccar 392 at 8:45am for Section A and at 10:30am for Section B. Attendance is required. The live class sessions will be recorded for later review, but no synchronous remote Zoom option will be available.
>
> **After Class:** There may be a video or a set of videos to watch (posted on Canvas) that should be watched *after* the live class session.

Canvas

Canvas will include a separate page for each class session with detailed instructions on what should be done before and after class and links to download class materials. The downloads will typically includes class slides and spreadsheets, including a data spreadsheet (which is what we will start with when building the models) and a completed spreadsheet (after building and solving the models). After class, an updated version of the class slides will also be posted that includes any notes I scribbled on them during class.

Problem Sets

Four graded problem sets will be assigned in order to provide you the opportunity to develop and apply the concepts and tools discussed in class. Modeling with spreadsheets is best learned by doing. Therefore it is critical that every student first attempt to set up and solve each of the problems in the problem set on their own. It is fine (even encouraged) to discuss and/or get help from classmates. Any help provided should be via discussion only and should *not* include sending or copying of files or portion of files. Everything in your individual submission should be entered by you, based on your understanding of the material. This individual attempt should be submitted to Canvas. The individual submissions will be reviewed, but only graded for completion and effort with feedback given only if there was a deficiency in completion or effort. Students should then meet in their pre-assigned study teams to compare solutions, clarify issues that were encountered, and streamline the various analyses into a single submission from the team. Take this opportunity to make sure everyone on the team understands the material and everything in the team assignment that is being submitted. At this stage (after everyone on the team has submitted their individual submissions), sharing of files is permitted. One member of each team should submit the team submission to Canvas. If possible, include all spreadsheets in a single workbook on separate tabs. The team submissions will be graded for accuracy and correctness, with thorough feedback provided.

Final Exam

The final exam will be an untimed take-home that is open book, open notes, but must be completed individually, without assistance from any other person, and without the use of the internet (other than the class Canvas site).

Grading Policy

The course grade will be based on class participation, problem sets, and a final exam. The final grade will be based on the following weights:

- Class Participation 10%
- Problem Sets (Individual): 15%
- Problem Sets (Team): 25%
- Final Exam: 50%

Attendance

Attendance is required at *all* class sessions (review sessions are optional). If you must miss a class session with an appropriate excuse (e.g., illness, non-informational interview that may not be rescheduled) please email me *before* the class session for pre-approval to receive an *excused* absence.

Panopto Recordings

All class sessions are recorded via Panopto. The recordings will only be accessible to students enrolled in the course to review materials. These recordings will not be shared with or accessible to the public. The primary purpose of the recordings is so that after attending the class session, you can go back and review material as needed to clarify your understanding. In the event of an unavoidable absence, the recordings should be viewed in their entirety. However, this should be viewed as a last resort, as watching a recorded class meeting is a poor substitute for attending class in person (e.g., there is limited audio capture of student voices, a lack of interaction and the ability to ask questions, and it does not allow you to contribute to the learning of your peers, thereby robbing them of your insights).

Class Participation

Class participation is important. The class should be a common learning experience. Thus, we want you to take ownership and initiative for the success of the class. It is critical that you arrive for each class fully prepared. Share your knowledge and help others understand your point of view. Some of the criteria we will use to judge the effectiveness of your participation include: Were you on task in classroom activities with your peers. Were you willing to participate in group discussions? Were your comments relevant to the discussion? Were you a good listener as well as speaker? Did you participate on the Canvas discussion boards?

Your participation will be tracked at each class session by the TA. (Please display your name placards to assist with this.) Generally, you will earn 0% for non-participation (either absent or in the room but not on task nor working with peers), 80% for being on task and working with peers, and 80%+ for being on task and also contributing to shared learning by actively adding to the class discussions. For *excused* absences, you will be given the opportunity to "make up" the learning experience and not suffer a grade penalty for the missed class participation.

Academic Integrity and the MBA Honor Code

By being a student in this course you acknowledge that you are a part of a learning community at the Foster School of Business that is committed to the highest academic standards. As a part of this community, you pledge to uphold the fundamental standards of honesty, respect, and integrity, and accept the responsibility to encourage others to adhere to these standards. Furthermore, as part of the Foster MBA program, we have jointly agreed to conform to and uphold the MBA Honor Code. In the interest of both your own learning and growth and fairness to classmates, any academic work product that you submit in the course must be your own. Please do not use generative AI tools (such as ChatGPT, DALL•E, etc.) in any way in the creation of your deliverables in the course.

Religious Observance Accommodation

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)

Schedule

Tuesday, March 28: Session 1

Introduction to Decision Modeling

Skim: Text, Chapter 1

In this session we will discuss the role of models in managerial decision making, and provide an overview of the models and techniques to be covered during the quarter. Then we will play the *Burrito Game* to experiment with solving a practical business problem and introduce you to the power of optimization.

Thursday, March 30: Session 2

Introduction to Linear Programming

Read: Text, Chapter 5 (skip Section 5.6) *(Ch. 2 in 5th-6th edition)*

Through a hands-on example (using Lego building blocks), we introduce the linear programming model. We will then discuss the use of the Solver feature in Microsoft Excel for modeling and solving such problems. We discuss the benefits and pitfalls of modeling a problem as a linear model. Finally, we examine the process of solving linear programs and basic properties of their solutions.

Problem Set 1 (Burrito Game Championship and Product Mix)

Individual Submission **due by 11:59pm on Monday, April 3**
Team submission **due by 11:59pm on Tuesday, April 4**

Tuesday, April 4: Session 3
Applications of Linear Programming Models

Read: Text, Chapter 6 *(Ch. 3 in 5th-6th edition)*

In this session we learn to recognize the various kinds of managerial problems to which linear programming can be applied. We will formulate linear programs that address problems from a variety of different business areas.

Thursday, April 6: Session 4
Prudent Financial Services Case Study

Read: Text, Chapter 7 *(Ch. 4 in 5th-6th edition)*

Read (but do NOT prepare): Case 7–1 "Prudent Provisions for Pensions" (at the end of Chapter 7 and also available in the paper course packet just before Session 4 or on Canvas under Session 4).

The objective of this session is to improve your ability to develop models in spreadsheets. We discuss the process of modeling, some guidelines for building good spreadsheet models, and techniques for debugging spreadsheet models.

Problem Set 2 (Linear Programming Applications)

Individual Submission **due by 11:59pm on Monday, April 10**
Team submission **due by 11:59pm on Tuesday, April 11**

Tuesday, April 11: Session 5
Sensitivity Analysis

Read: Text, Sections 8.1–8.6 (skip Ch. 8 subsections covering Parameter Analysis Reports) *(Sec. 5.1–5.6 in 5th-6th edition)*

We discuss the use of Solver output for performing post-optimality or sensitivity analysis for linear programs. This analysis is useful in testing the robustness of the solutions to a particular model, and also in providing valuable economic information about the problem being analyzed.

Thursday, April 13: Session 6
Integer Models

Read: Text, Chapter 10 *(Ch. 7 in 5th-6th edition)*

In this session we address problems where some or all of the decision variables are required to assume integer values. We discuss when rounding is appropriate and when it is not. We also discuss the application of binary variables to making "yes-or-no" type decisions.

Problem Set 3 (Sensitivity Analysis and Integer Models)

Individual Submission **due by 11:59pm on Monday, April 17**
Team submission **due by 11:59pm on Tuesday, April 18**

Tuesday, April 18: Session 7
Introduction to Decision Analysis

Read: Text, Sections 12.1–12.3 (replacing the Analytic Solver coverage in 12.3 with the Supplement to Chapter 12: TreePlan available on Canvas and also in the packet before the Session 7 class notes) *(Sec. 9.1–9.3 in 5th-6th edition)*

We discuss an approach to making decisions when there is uncertainty or risk present. We will discuss different criteria for making decisions and introduce decision trees as a tool for framing these problems. The TreePlan Excel add-in for developing decision trees is demonstrated.

Thursday, April 20: Session 8
Value of Information and Risk Attitude

Read: Text, Sections 12.4–12.11 *(Sec. 9.1–9.3 in 5th-6th edition)*

Here we will discuss methods for adapting decision trees to evaluate the value of information that might be gathered before a decision needs to be made. Then we introduce the concept of risk aversion and discuss the importance of incorporating risk attitudes in a decision analysis model. We will discuss the use of utility functions to model risk aversion.

Problem Set 4 (Decision Analysis)

Individual Submission **due by 11:59pm on Monday, April 24**
Team submission **due by 11:59pm on Tuesday, April 25**

Tuesday, April 25: Session 9
Simulation and Crystal Ball

Read: Text, Sections 22.1–22.3, first part of 22.7 (electronic chapter available on Canvas)

In this session we discuss and demonstrate the role of simulation as a tool for analyzing systems involving uncertainty or risk. We discuss the use of the Crystal Ball Excel add-in for performing Monte-Carlo simulation.

Thursday, April 27: Session 10
Applications of Simulation

Read: Text, Section 22.4–22.5, rest of 22.7 (electronic chapter available on Canvas)

In this session we continue discussion of Monte-Carlo simulation and the Crystal Ball Excel add-in and its application to various business problems.

Problem Set 5 (Simulation)

Individual Submission **due by 11:59pm on Monday, May 1**
Team submission **due by 11:59pm on Tuesday, May 2**

Thursday, May 4: Final Exam Available at 1:00pm
Sunday, May 7: Final Exam Due by 11:59pm