Decision Making and Modeling

Spring 2018

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What this course is about

This course introduces fundamental concepts and models for decision making under uncertainty. This knowledge is fundamental both for your course work and in your future career as decision maker and business leader.

Learning in this course has four components:

• *Probability concepts*. We introduce powerful formal tools of probability theory to help us conceptualize and solve decision problems involving risk.

• *Decision making principles*. These are qualitative principles of broad relevance to decision making, such as the “flaw of averages,” risk aversion, value of information, option value, adverse selection, herd behavior, among others.

• *Modeling*. The course will demonstrate how to use spreadsheet models to represent and solve managerial decision problems.

• *Simulations*. Most real-world problems are of a degree of complexity that precludes analytical solutions. Businesses increasingly use simulations to evaluate risks and make decisions. The course will introduce you to state-of-the-art *Palisade’s DecisionTools Suite* (which includes @Risk and PrecisionTree) to perform and interpret simulations.
Prerequisites and Support

The course assumes basic knowledge of elementary probability concepts and basic spreadsheet skills. The elementary skills I will assume are at the level of:

- The use of “$” in Excel (e.g., the difference between referring to a cell as B3, B$3, or $B$3);
- Basic familiarity with conditional statements: =IF(, , , , , , ,
- Sorting rows of data.

The course does not assume prior knowledge of simulations, probability concepts, or advanced Excel skills. I will provide you with the support you need in learning and mastering the more advanced skills introduced in this course.

Software

You will need to purchase an educational copy of Palisade’s DecisionTools Suite. Kellogg Information Systems (KIS) will provide you with a key and instructions to obtain a one year educational license, at a cost of about $30. Details will be forthcoming in week 1.

Class participation and attendance

Attendance is expected and class participation is strongly encouraged. Your final grade can change by up to 15% to reflect class participation and contribution to team effort. I will take note of class participation and attendance each week and may circulate a peer review form at the end of the quarter to evaluate contributions to group effort.

You will be able to report your absence using a link to an internet form. As a general policy, missing 3 sessions without valid medical or business reasons will typically result in being downgraded by one letter grade, missing 6 sessions by two letter grades, and more frequent absences in a failing grade.
Grade Components

The requirements are homework, a take-home midterm progress test, and a final exam.

1. **Homework**: There are two types of homework
   - *Group homework*: The class will be divided into study groups in week 2. Submit electronically one copy per group.
   - *Individual homework*: You need submit homework 1 and either 4 or 6 via Canvas.

   A homework is usually distributed 5-7 days before its due dates.

   The Honor Code Policy for individual homework is that you may not discuss the questions with other students (in any section) currently taking this course or have taken it in the past. You may, however, discuss general course topics, concepts, past homework, and general Excel skills with others. The Honor Code for groups is similar.

2. **Midterm Take-Home Progress Test**: This is a set of problems designed to test your understanding halfway through the course. Unlike ordinary homework, the progress test must be completed within a short time window of a few hours. The test will involve spreadsheet modeling and simulations. Details and logistics will be discussed in class.

3. **Final Exam**: Exam will take place during final exams week (usually, the 7 day period that follows the last class). The exam is cumulative and will be open book, notes and laptop.

   You will have to complete the final exam within a limited time window (e.g., \(x\) hours, where \(x\) will be announced at a later date) anytime of your choice during final exams week. Details about logistics will be announced in class.

*Grade distribution:*

- Homework 25%; Midterm 25%; Final 50%.

The score may be adjusted to reflect participation, peer review, and attendance as described above.
Optional Vignette

A vignette is a short term paper, usually 5-7 pages, that presents an application of course concept, an update of course example, an interesting new example, or a related work experience. Writing a vignette about something you are excited about can be very rewarding. Further details will be provided in class.

*Grade distribution with the vignette option:*

- Homework 20%; Midterm 20%; Final 40%; Vignette 20%.

A vignette may be completed by no more than one subset of each study group (this gives individual members to opt out).

Course References

*There is no formal textbook for this course.* All of the course’s concepts will be stated and explained in course slides and handouts. Simulations techniques will be illustrated in class and using videos and online tutorials so you can review and practice these skills at home.

Students who like to have access to references to look up concepts may consult the following, which will be available free of charge:


- McKeon, Scott: *Excel Basics*, Kellogg School of Management.

I also highly recommend as **optional reading**:


This book has many nice examples and intuitive explanations, some of which will be used in class. A copy of the book sells for about $15.
Course Outline
Week 1  |  Stopping Problems

Tuesday, April 3, 2018.

Session 1  |  Introduction; Customer’s Lifetime Value

Churning in the Mobile Phone Business
Please attempt to answer this problem (an optional template to structure your answer is also provided):


Failure Analysis (Optional)
Take a look at this problem before class (nothing to submit). We will go over it timing permitting:


Session 2  |  Clustering and Coincidences

The Cancer-Cluster Myth (Optional)

Week 2  | Aggregating Small Risks

Tuesday, April 10, 2018.

Homework 1 due (Individual)

Session 3  | The Normal Distribution & The CLT

We introduce two of the most important concepts in probability: the normal distribution and the central limit theorem. We explore a number of their applications to: (1) monitoring a business process, (2) insurance, (3) the supply curve, among others.

Session 4  | Applications

Copper in 2008


Nature’s Casino

Please skim the first reading on this topic:


Related readings (optional):


Week 3  |  Correlation

Tuesday, April 17, 2018.

Homework 2 due (Group)

Session 5  |  Correlation

We review the concepts of dependency between random variables: Bayes rule, covariance, and correlation coefficient. These concepts will be illustrated in a number of examples and applications: U.S. elections, insurance, supply chain disruptions, and others.

Session 6  |  Structured Finance and the 2008 Crisis

Structured Finance


Week 4  |  The Flaw of Averages

*Tuesday, April 24, 2018.*

Homework 3 due (Group)

Session 7  |  The Butane Case

The Union Carbide Butane Case
Questions about this case will be included as part of the homework:


Session 8  |  Variability and the Flaw of Averages

Airline Booking (to pass out in class)

Week 5 | Risk and Risk Aversion

Tuesday, May 1, 2018.

Homework 4 due (Individual)

Session 9 | Risk: Worst Case Analysis

Deal or No Deal

Please read and answer the questions in:

• Al-Najjar, N.I.: “Deal or No Deal,” Kellogg School of Management, 2011.

Session 10 | Risk Aversion and Exponential Utility

Drill-Baby-Drill

Please read and answer the questions in:

• Al-Najjar, N.I.: “Drill-baby-drill,” Kellogg School of Management.
Week 6 | Extreme Events

Tuesday, May 8, 2018.

Take-Home Midterm Progress Test Due

Session 11 | Extreme Outcomes and Thick Tails

The Long Tail


Network Effects


Session 12 | Catastrophes and Near Misses

Week 7  |  Information and Decision Trees

Tuesday, May 15, 2018.

Tuesday, May 15, 2018 (Group)

Session 13  |  Decision Trees and Framing

The Weston Case

Questions about this case will be included as part of the homework:


Session 14  |  Bayes Rule

A Formula for Success (Class only)

This short reading will be distributed in class.

Week 8 | Selection Bias

**Tuesday, May 22, 2018.**

Homework 6 due (Individual)

**Session 15 | The Value of Information**

Blind Shear Rams

Questions about this case will be included as part of the homework:


**Session 16 | Selection Bias**

Buying a Start-up with Unknown Value

Please read and answer the questions in:

- Al-Najjar N.I.: “Buying a Start-up with Unknown Value,” Kellogg School of Management.

Credit Solicitation

Please read the credit card case and try to answer the questions at the end of the case.


Gaming Health Insurance

Please read and answer the questions in:

Week 9 | Optionality

Tuesday, May 29, 2018.

Homework 7 due (Individual)

Session 17 | Cost Uncertainty

Questions about this case will be included as part of the homework:

- Besanko, D.: Exercise on Cost Uncertainty, Kellogg School of Management.

Session 18 | BATNA and Uncertainty

Questions about this case will be included as part of the homework:


Additional Readings

Please read and answer the questions in:


Week 10 | Aggregating Opinions

Tuesday, June 5, 2018.

Session 19 | Wisdom of the Crowds

- **Required preparation:**
  - “Wisdom of the Crowds,” Kellogg School of Management.

- **Required reading:**

Session 20 | Conformity and Herd Behavior

- **Required reading:**

- **Readings:**
  - Silver, N.: “Here is Proof Some Pollsters are Putting a Thumb on the Scale,” Fivethirtyeight.com, November 14, 2014.
Final Exam

- Final Exams Week is the periods:

  Monday, June 11, 2018.
  through
  Friday, June 15, 2018.

- The in-class final takes place during final exams week.

- The date of the exam is set by the Student Affairs office, not the faculty teaching the course. Student Affairs posts the dates on their web page later in the quarter. Please contact them directly if you need to know the dates earlier.

- You can take the exam early for a valid medical or business reason.

- The final exam will be three hours long, open-book, open-notes. Access to a computer and Palisade software is required.