

# DSO547: Designing Spreadsheet-Based Business Models<sup>1</sup>

Fall 2020

Sections 16223 and 16278 (TTh 11:00AM)

University of Southern California – Marshall School of Business

Instructor: Hiroshi Ochiumi  
Office: On-Line  
Office hours: **Thursday 4PM-6PM**  
Phone: Not Forwarded  
Email: ochiumi@marshall.usc.edu

## Course Description

Spreadsheets are convenient and widely available platforms for organizing information and performing “what if” analyses. Excel therefore, has become an indispensable tool for business analysis. This course will focus on structuring, analyzing and solving managerial decision problems on Excel spreadsheets.

**This course is not about becoming an Excel expert, but about modeling through Excel.** Its goal is to train you to become an effective modeler who can build sound models to solve business problems.

We will study three broad classes of managerial problems:

1. **Resource Allocation:** How to optimally allocate a limited pool of resources among available opportunities. This is the most common managerial problem, occurring in every functional area. Examples in finance include constructing an optimal risk-return portfolio, and capital budgeting. Examples in marketing include media planning, and sales force territory planning. In operations management resource allocation problems arise in capacity, logistics and operations planning.
2. **Decision Analysis/ Contingent Decisions:** How to synthesize a sequence of decisions involving uncertainty. An intuitive approach to handling uncertainty is to explore the possibility of deferring a decision until some uncertainty is resolved, especially when the stakes are high. If we can we should make sequence of decisions instead of one big decision. Business examples where such decision techniques are used include dynamic portfolio management, new product development, and capacity expansion planning.
3. **Risk Analysis:** How to incorporate uncertainty in problem parameters. Almost always managerial decisions are based on anticipated states of the business environment. Clearly as the decision horizon becomes longer there is an increase in uncertainty. Managers have to carefully consider different potential scenarios while making decisions. In this part of the course we will learn how to explicitly incorporate uncertainty into business models.

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<sup>1</sup> August 18, 2020. Any update will be posted in Blackboard.

## Course Objectives

Upon successful completion of this course, students will be able to:

1. Convert a business situation into an Excel model.
2. Build linear programming, integer programming, non-linear programming models using Excel, and find an optimal solution using Excel Solver.
3. Construct decision trees to find the optimal set of contingent decisions.
4. Conduct sensitivity analyses to examine the robustness of the solution.
5. Build Monte-Carlo simulation models using Excel and Crystal Ball, and evaluate risks associated with a project.

## Textbook

*Business Analytics: The Art of Modeling with Spreadsheets* 5<sup>th</sup> ed. by Stephen G. Powell and Kenneth R. Baker (John Wiley & Sons).

## Excel Skills and Software

Previous knowledge of Excel is not required. Knowing how to enter formulae involving relative and absolute cell addresses, and how to graph using chart wizard is sufficient. We will learn to use a set of Excel add-on tools to find optimal resource allocations, analyze contingent decisions, and simulate the effects of uncertainty.

## Grading

Homework 1-5	25%
Spreadsheet 1-8	24%
Midterm Exam	20%
Final Exam (cumulative)	26%
Class Participation	5%

There will be absolutely no other assignments.

Exams are on-line and open book/notes. There are no make up exams.

Homework assignments and Spreadsheet assignments are accepted only via Blackboard. Late assignments will not be graded.

## Homework Assignments

Please form groups of **4 or less** students (2 or 3 is recommended). All the members in a group will receive the same score. You can form different groups for different Homework assignments.

## Spreadsheet Assignments

These are **individual** assignments. Starting Week 4 (due Week 5), each student is required to complete a spreadsheet model. The problem is announced in class and due the following Tuesday.

## Blackboard

We will use Blackboard as our “information center”. Handouts, assignments, solutions, syllabus updates, supplementary reading materials, for instance, will all be posted there.

### **Academic Conduct:**

Students are expected to make themselves aware of and abide by the University community's standards of behavior as articulated in the [Student Conduct Code](#). Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct at <http://policy.usc.edu/scientific-misconduct>.

### **Support Systems:**

*Counseling and Mental Health* - (213) 740-9355 – 24/7 on call  
[studenthealth.usc.edu/counseling](http://studenthealth.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline* - 1 (800) 273-8255 – 24/7 on call  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention and Services (RSVP)* - (213) 740-9355(WELL), press “0” after hours – 24/7 on call  
[studenthealth.usc.edu/sexual-assault](http://studenthealth.usc.edu/sexual-assault)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED)*- (213) 740-5086 | Title IX – (213) 821-8298  
[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

*Reporting Incidents of Bias or Harassment* - (213) 740-5086 or (213) 821-8298  
[usc-advocate.symplicity.com/care\\_report](http://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*

[uscса.usc.edu](http://uscса.usc.edu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.

**Time Table (Tentative)**

Date	Topic
Aug. 18	<p><b>Course Introduction</b> Objective, outline, textbook, expectations;</p> <p><b>Introduction to Modeling (Chapters 1 and 2)</b> Definition of modeling, types of models, examples, a simple profit model, card game observation and analysis, modeling steps</p>
Aug. 20	<p><b>Optimization – Introduction (Chapter 9)</b> Model components, success stories, advertising mix problem (math formulation, spreadsheet layout and solver setup), Excel solver setup, model layout</p>
Aug. 25 Aug. 27	<p><b>Optimization – Linear Programming (Chapter 9)</b> Linear functions, linear vs. nonlinear programming, types of LP problems, Veerman furniture (allocation) problem, Dahlby outfitters (covering) problem, Diaz coffee company (blending) problem</p> <p><b>HW0 is due August 27. HW0 does not affect the course grade.</b></p>
Sep. 1 Sep. 3 Sep. 8	<p><b>Optimization – Network Models (Chapter 10)</b> Network components and diagram, transportation problem, assignment problem, standard form, oil pipeline problem, inventory problem, tuition planning problem</p>
Sep. 10	<p><b>Optimization – LP Sensitivity Analysis</b></p> <p><b>HW1 is due September 10.</b></p>
Sep. 15 Sep. 17 Sep. 22	<p><b>Optimization – Integer Programming (Chapter 11)</b> Solver behavior, types of IP models, solver setup, relationship between IP and LP (machine tool problem), staff scheduling problem, project selection problem, binary variables for logical relationships, baseball problem, set covering problem, fixed cost problem, machine assignment problem, quantity discount problem, eight-queen problem</p> <p><b>Spreadsheet 1 is due September 15.</b> <b>HW2 is due September 17.</b> <b>Spreadsheet 2 is due September 22.</b></p>

Sep. 24 Sep. 29	<p><b>Optimization – Nonlinear Programming (Chapter 8)</b> Challenge posted by nonlinear programming models, solver setup and tips, facility location problem, revenue maximization problem, curve fitting problem, portfolio optimization model</p> <p><b>HW3 is due September 24.</b> <b>Spreadsheet 3 is due September 29.</b></p>
Oct. 1	<b>Midterm Review</b>
Oct. 6	<b>Midterm Exam</b>
Oct. 8 Oct. 13 Oct. 15	<p><b>Decision Tree Analysis (Chapter 13)</b> Basics, decision tree diagram, drug development problem, rollback procedure, Treeplan add-in, new-product introduction problem, sensitivity analysis, DriveTek contract problem</p> <p><b>Spreadsheet 4 is due October 13.</b></p>
Oct. 20	<p><b>Simulation – Introduction (Chapter 14)</b> Motivation example, what/why/how, random number and RAND() function, common probability distributions (binomial, normal, uniform, triangular, ...), histogram, a profit-calculation problem, Crystal Ball basics, general steps in simulation</p> <p><b>Spreadsheet 5 is due October 20.</b></p>
Oct. 22 Oct. 27	<p><b>Simulation – Finance Examples</b> Butson store problem (illustrating steps of simulation using Crystal Ball), Netscape valuation problem, option pricing problem; Crystal Ball tips: tornado chart, correlation among inputs, and CB functions</p> <p><b>HW4 is due October 22.</b> <b>Spreadsheet 6 is due October 27.</b></p>
Oct. 29	<p><b>Simulation – Marketing Examples</b> New product introduction problem (the Bass diffusion model), customer retention problem; Crystal Ball tip: build an open-end CB model</p>
Nov. 3 Nov. 5	<p><b>Simulation – Operations Examples (Chapter 15)</b> Hastings sportswear problem (newsvendor problem), contract bidding problem, order due-date problem; Crystal Ball tip: grid search and replication</p> <p><b>Spreadsheet 7 is due November 3.</b> <b>HW5 is due November 5.</b></p>
Nov. 10	<p><b>Simulation – Game Examples</b> The Craps game, basketball tournament model, etc.</p> <p><b>Spreadsheet 8 is due November 10.</b></p>
Nov. 12	<b>Conclusions</b>
Nov. 17 11am- 1pm	<p><b>Final Exam</b> <b>No early exam is allowed due to the university policy.</b></p>

