PPD 557  Modeling and Operations Research

UNIVERSITY of SOUTHERN CALIFORNIA
SCHOOL of POLICY, PLANNING, and DEVELOPMENT

Professor Elizabeth Graddy

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Office: RGL 312D (213)740-5725 graddy@usc.edu
Office Hours: Tuesdays 1:00-2:00pm or by appointment (via Connie Rodgers crodgers@usc.edu)
Class: Tuesdays 2:00-5:20pm in RGL 219

Teaching Assistant: Scott Sternberg  Office Hours: TBD

Course Materials are available via Blackboard at https://blackboard.usc.edu

PREREQUISITE: Applied Social Science Statistics (MPP Lab, PPD 404, or equivalent)

COURSE OBJECTIVES:

This course emphasizes the development of analytic modeling skills, and the effective application of operations research methods in policy, management, and planning settings. A set of widely used models including linear programming, decision analysis, queuing, and forecasting is introduced. We explore how to effectively use these models, as well as their strengths and limitations in different problem and organizational contexts.

The goal of this course is to train managers and analysts to be intelligent consumers of quantitative analysis as an aid to solving complex problems. To this end, students will learn:

- to structure problems so they can be effectively addressed,
- to formulate models that are useful in different decision situations,
- to use spreadsheet software to solve these models
- to effectively present quantitative analysis to clients

These skills are particularly useful for those interested in management consulting, those seeking to manage public, nonprofit, or business organizations, and those seeking staff analyst positions in such organizations.

Since much quantitative analysis takes place as advice to clients within specific organizations, organizational knowledge is as important as technical expertise. To provide such a context for the
material we will be covering, you will assume a role as a consultant to a particular organization throughout this course.

COURSE REQUIREMENTS:

Organization Selection. Your organization selection is DUE January 20. You may choose any organization that interests you within your assigned sector. To ensure an interesting mix of public and private organizations I will randomly assign students to a sector (public, nonprofit or business) at the end of the first class. If you have a strong preference as to sector – and/or an interest in a particular organization, let me know immediately. I will honor all such requests unless the sector balance is violated.

Give careful thought to the selection of your organization, as your Application will be a consulting product for that organization.

The course grade will be based on three major components: problem sets, examinations, and an application.

1. Problem Sets. Problem sets will account for 33% of the course grade. Unless otherwise stated, all problem sets are DUE one week after distribution. It will usually be possible to receive credit for problem sets that are up to one week late. After that date, no credit will be given for late problem sets.

2. Examinations. There will be two examinations, each worth 20% of the course grade. The first examination will be given after we have completed goal programming. The second examination will be given at the end of the course, but will only include the material covered after the first examination. You are free to use your notes during the examinations (but no books are allowed).

3. Application. Students are required to apply one of the methods studied in the course to a real decision (20% of the course grade). Select a problem/decision of interest to your organization, then model the problem, perform the analysis, and prepare a recommendation.

Your product should be in the form of a MEMO to your client (with analysis attached). The memo must:

- Describe the problem and recommend a course of action.
- In support of your recommendation:
  -- outline how your methodology and analysis aided your decision,
  -- why the selected methodology was appropriate for this particular kind of problem,
  -- point out any limitations/concerns about the validity of your analysis.
- Include your quantitative analysis output/calculations as an attachment.
- Include a DATA APPENDIX that describes in detail the data, their source and how they were collected, and addresses any reliability concerns.

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1 For those of you unfamiliar with the professional memo format, refer to the tradecraft writing manual available on our intranet at: http://www.usc.edu/schools/sppd/sppdnet/tradecraft.html
Data collection may prove to be time consuming (and frustrating!). I suggest you start early. Ideally, you will be able to obtain the necessary data directly from your organization, so you should start developing connections early. If this is not possible, you will need to identify publicly available sources for the necessary data.

4. Presentation. Students will present their application results to the class using Power Point. You will be assigned to small groups based on organization characteristics and methodology. Each group will have about 20 minutes for their presentation. Each group presentation will include a brief presentation by each student in the group of the problem he/she explored and the insight provided by the analysis (no more than 5 minutes each). Then, the group will compare and contrast their applications for the class emphasizing what they learned from each other that enhanced their understanding of the methodology used. The class will then be able to ask questions to the group. Our focus will be on the correct and effective use of methodology. There will be peer evaluations of the presentations, which will account for 7% of the course grade.

To summarize, the course grade is assigned as follows:

- Problem Sets: 33%
- Examinations: 40%
- Application: 20%
- Presentation: 7%

REQUIRED TEXT:


ARTICLES:


COMPUTER REQUIREMENTS and RESOURCES:

Many of the quantitative methods covered in this course require the use of computer software. You will need access to the following:

- A Spreadsheet software package with the ability to solve mathematical functions. While you may use any package with which you are familiar, I will use EXCEL for instructional purposes. EXCEL is available on PCs in the various computer labs on campus.

- The Data Analysis and Solver functions in EXCEL. For most versions of EXCEL, these functions are add-ons. Adding them to your system is easy: enter EXCEL, pull down the TOOLS menu, click on Add-Ins, and check the “Analysis ToolPak Add-In” and “Solver Add-In” options.

- Power Point. Power Point slides of my lectures are available on Blackboard. I encourage you to print these before class as Handouts (which provide space for notes). This will allow you to focus on engaging the material during lectures, rather than just taking notes. This will require access to Power Point software. All UCS PCs have Power Point and Excel installed for your use.

Finally, all students are required to have an SCF account or other e-mail capability. We will use e-mail for out-of-class communications during the semester. Please ensure that Blackboard displays your preferred email address so that you can be contacted as needed.

Disability Services

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or the TA) as early in the semester as possible. DSP is located in STU 301 and is open early 8:30 a.m. – 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.
## Class Schedule

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| **January 13**| COURSE INTRODUCTION<br>INTRODUCTION to MANAGEMENT SCIENCE  
⇒ Sector Assignments                                |
| **January 20**| INTRODUCTION to MODELING  
Readings: Taylor, ch. 1, Starfield, Smith & Bleloch, ch. 2  
⇒ Organization Selection DUE                       |

### Deterministic Models

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| **January 27**| LINEAR PROGRAMMING: Solution Algorithms, Sensitivity Analysis  
Readings:  Taylor, chs. 2-3; Earnshaw & Dennett |
| **February 3**| LINEAR PROGRAMMING: Model Formulation  
Readings:  Taylor, ch. 4; Aubin  
⇒ PS 1 Due                                                |
| **February 10**| INTEGER PROGRAMMING  
Readings:  Taylor, ch. 5; Gordon & Erkut  
⇒ PS 2 Due                                                |
| **February 17**| GOAL PROGRAMMING  
Readings:  Taylor, ch. 9; Zografos & Oglethorpe  
⇒ PS 3 Due                                                |
| **February 24**| EXAMINATION  
⇒ Bring Blue Book                                       |

### Decision Making under Uncertainty

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| **March 3**   | DECISION ANALYSIS I  
Readings:  Taylor, ch. 12 (if needed, review Taylor, ch. 11); Stonebraker |
| **March 10**  | DECISION ANALYSIS II  
Readings:  Keeney; Dunning et al.  
⇒ PS 4 Due                                                |
| **March 17**  | SPRING BREAK                                          |
March 24  QUEUING MODELS  
Readings:  Taylor, ch. 13; Green and Kolesar

March 31  FORECASTING  
Readings: Taylor, ch. 15; Tilman  
⇒ PS 5 Due  
⇒ Application Methodology DUE

Presentations

April 7  Wrap-Up & Presentation Preparation  
⇒ PS 6 Due

April 14  APPLICATION PRESENTATIONS

April 21  APPLICATION PRESENTATIONS  
⇒ Applications Due (No Grace Period)

April 28  EXAMINATION  
⇒ Bring Blue Book

May 5-14  Participation in SPPD Capstone Activities
ACADEMIC RESPONSIBILITY

"Students, faculty, and administrative officials at the University of Southern California, as members of the academic community fulfill a purpose and a responsibility.

The University must, therefore, provide an optimal learning environment, and all members of the University community have a responsibility to provide and maintain an atmosphere of free inquiry and expression. The relationship of the individual to this community involves these principles: Each member has an obligation to respect:

1. THE FUNDAMENTAL HUMAN RIGHTS OF OTHERS
2. THE RIGHTS OF OTHERS BASED UPON THE NATURE OF THE EDUCATIONAL PROCESS
3. THE RIGHTS OF THE INSTITUTION

ACADEMIC DISHONESTY

The following statements and examples explain specific acts of academic dishonesty.

1. **Examination Behavior**: Any use of external assistance during an exam is considered academically dishonest unless expressly permitted.
   a. Communicating in any way with another student during the examination.
   b. Copying material from another student's exam.
   c. Using unauthorized notes, calculators or other devices.

2. **Fabrication**: Any intentional falsification or invention of data or citation in an academic exercise will be considered a violation of academic integrity.
   a. Inventing or altering data for a laboratory experiment or field project.
   b. Resubmitting returned and corrected academic work under the pretense of grader evaluation error, when, in fact, the work has been altered from its original state.

3. **Plagiarism**: Plagiarism is the theft and subsequent passing off of another's ideas or words as one's own. If the words or ideas of another are used, acknowledgement of the original source must be made through recognized referencing practice.
   a. **Direct Quotation**: Any use of a direct quotation should be acknowledged by footnote citation and by either quotation marks or appropriate indentation and spacing.
   b. **Paraphrase**: If another's ideas are borrowed in whole or in part and are merely recast in the student's own words, proper acknowledgement must, nonetheless, be made. A footnote or proper internal citation must follow the paraphrase material.
4. **Other Types of Academic Dishonesty:**

   a. Submitting a paper written by another;
   b. Using a paper or essay in more than one class without the instructor's express permission;
   c. Obtaining an advance exam copy without the knowledge or consent of the instructor;
   d. Changing academic records outside of normal procedures;
   e. Using another person to complete homework assignment or take-home exam without the knowledge and consent of the instructor.

The above information is taken directly from the **SCampus** and the Academic Affairs Unit of the Student Senate in conjunction with the Academic Standards Committee.