UNIVERSITY OF NEVADA LAS VEGAS
Civil and Environmental Engineering and Construction Department
CEE 762 Operations Research Applications in Civil Engineering

Course Description

Analysis of civil engineering systems using operations research methods and techniques. Methods covered include optimization models in deterministic systems, network models, and queuing theory. Applications drawn from various civil engineering contexts.

Prerequisites

Graduate standing

Required Skill Proficiency in word processing, spreadsheet, and presentation software

Computer Usage Use of electronic spreadsheets, presentation graphics, and word processing

Student Learning Outcomes

- Understand the basic concepts of building mathematical programming models
- Understand how to model engineering problems as linear programming problems
- Understand how to solve linear programming problems, and interpret and analyze their solutions
- Understand special linear programming models, including network optimization models, CPM models, transportation and traffic assignment models
- Understand the basic concepts and types of non-linear programming models
- Have the ability to solve and analyze non-linear programming problems using special software
- Understand queuing theory concepts and models and their applications
- Understand the fundamentals of building computer simulations models
- Apply the concepts learned in this course to a real-world engineering problem

Organization and Delivery

Students will have to work in teams of **3-5** students per group. It is up to students to decide on group compositions. Students are required to maintain the same group members throughout the course. The project will be a company (client) project or a research project identified by faculty or the students. Each group will identify a tenured/tenure track faculty to be their primary advisor.

All proposed capstone projects will need to be approved by the MSQF program director to ensure that learning objectives will be met. The faculty advisor and MSQF program director will be the

main points of contact for each group. Groups are mandated to periodically meet with their faculty advisor and MSQF program director and report about work in progress and/or seek necessary guidance. It is the responsibility of each of the groups to set up these meetings.

Furthermore, groups are invited to seek advice from Finance faculty members and Lee Business School faculty members as specific needs arise. There is no formal class meeting schedule for this course. The primary advisor, MSQF director, and 1-2 other tenured/tenure track faculty members will serve as readers of the final reports. The oral presentation of the capstone project will be made to the same group of 3-4 faculty members.

Course Materials

Hillier and Lieberman, *Introduction to Operations Research*, McGraw Hill, 10th Edition, 2015.

Other References

- ReVelle and McGarity, Editors, *Design and Operation of Civil and Environmental Engineering Systems*, John Wiley & Sons, 1997.
- *Interfaces*, A technical journal published by INFORMS (Call No. HD 28.I45)

The *Interfaces* journal is an excellent source of documentation of real-world problems that people have solved or attempted to solve using OR. Please note that there are several other suitable reference materials in the library that you are encouraged to find and consult.

Course Requirements and Topics

Course Requirements

Students will engage in the following activities:

- Attend classes
- Read assigned material prior to class sessions
- Complete and submit course assignments
- Participate in class discussions
- Complete examinations
- Complete semester project

Course Topics

- Introduction
  - Introduction to OR (Chap 1)
  - Overview of modeling approach (Chap 2)
- Deterministic Modeling
  - Introduction to Linear Programming (Chap 3)
  - The Simplex method (Chap 4)
  - Duality theory and Sensitivity Analysis (Chap 6)

- Using the OR Courseware and Excel Solver
- Integer Programming (Chap 12)
- Transportation and Assignment Problems (Chap 9)
- Network Optimization Problems (Chap 10)
- Non-linear Programming (Chap 13)

- Stochastic Modeling
  - Queuing Theory and Applications (Chap 17)
  - Simulation (Chap 20)

Class Assignments

Assignment Policy

Assignments should be submitted in class on their due dates. In general, you will have about a week or two to work on each assignment. Assignments submitted late without pre-approval by the instructor will be subject to penalty or may not be accepted. Late submissions will not be accepted after solutions have been distributed or discussed in class.

Students are encouraged to discuss the assignments with fellow students. They should use such discussions to better understand the questions, the issues involved and/or alternative methods of solving the problems. However, the final submittal must be the result of the student's individual effort. Please be sure to provide proper credit (reference citations) where appropriate.

Presentation

Submitted assignment pages should be stapled together neatly, with a **title page** that has your name, date, class, and homework #. ***Please be neat and show your work very clearly. Homework solutions that present only the final answers without showing the necessary solution steps will get no or only partial credit even if the answers are correct***.

Term Project

Students will be required to identify a real-world engineering problem that can be solved with the application of OR principles and techniques presented in the course. It could be a design problem, an operations or a planning problem in any area of engineering. Students shall identify their own problems with the assistance of the instructor. Project milestones shall include submission of proposal, progress report, final report and oral presentation in class the last week of class.

Project schedule and deadlines will be discussed later in the semester. In the meantime, you are strongly encouraged to start thinking and exploring possible problems preferably ***in your area of interest***. Feel free to discuss with the instructor and/or your academic advisor any ideas you might have.

Date, Time, and Location of Final Examination

TBD

Disclaimer: The contents of this document are to be considered "tentative" and subject to change as the instructor deems necessary.

Grading

The weight on each component of the overall course grade are as follows:

- Midterm Exam 20%
- Final Exam 20%
- Assignments 40%
- Term Project 20%

Grading Scale:

Letter Grade	*Score Range*	*Subjective Criteria*
A	≥ 90%	Superior knowledge
B+	≥ 87%	Good knowledge
B	≥ 83%	
B-	≥ 80%	
C	≥ 70%	Minimum knowledge
D	≥ 60%	Did not meet minimum knowledge standards
F	Below 60%	Did not meet minimum knowledge standards

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