Operations Research
MATH 452/552–Spring 2006
MW–MYBK 223

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Course Description and Goals

Operations Research (O.R.) is the branch of engineering science that approaches large-scale "operations" problems in design and planning by forming abstract mathematical models of relevant problem phenomena and analyzing the models to evaluate decision alternatives. MATH 452/552 is one of two introductory O.R. courses. While MATH 451/551 focuses on the optimization part of operations research, MATH 452/552 focuses on the non-optimization part of operations research. We will discuss Markov chains, least squares, simulation, queueing theory, and potentially other methods that use little, if any, optimization theory.

This class will use problem-based learning. (From Wikipedia) Problem-based learning is a didactic concept of "active learning" in tertiary education, but is currently being adpted for use in K-12 education. The defining characteristics of PBL are: (a) learning is driven by messy, open-ended problems, (b) students work in small collaborative groups, and (c) teachers are facilitators of learning. Accordingly, students are encouraged to take responsibility for their group and organise and direct the learning process with support from a tutor or instructor.

Therefore, this class will begin with my presentation of 3-4 problems from the real world. These problems are vague and open-ended. Each group is assigned one problem and has the semester to devise a definite, specific approach to solve the problem using one of the operations research techniques mentioned above. I will direct groups and aid in understanding but the material will be primarily self-taught through discovery and inquiry. As a result, the class will not consist of lectures, instead groups will take turns presenting what they have learned and the progress they have made. I will fill in any gaps when necessary.

Clearly, the success of this class depends on your commitment as a student and group member. But the rewards of problem-based learning make this well worth it. The research, learning, and communication skills you will refine this semester are precisely those you will rely on in the future, whatever your chosen career path.

During this course you will :

- become a better researcher. You will be able to find appropriate resources, summarize their key points, and dig deeper into the most applicable ones.

- improve your communication skills. Working with a group, you are forced to "sell" your ideas through good communication, exposition, and demonstration. In addition, the frequent group presentations will make you much more comfortable with explaining new ideas.

- learn several new operations research models that can be applied in a wide variety of modeling settings. You will learn one model particularly well (the one used to solve your group's problem). You will learn about other operations research models through the presentations of other groups.

- become proficient with Matlab. A great way to truly understand a new mathematical model is to test it out on small examples, and experiment.

Course Principles

- *Participation.* This class can only succeed and be beneficial if all of us are committed to learning.

- *Shift.* Focus and responsibility is now shared by the teacher and students. There will be no more lectures or "spoonfeeding". You are learning how to "feed" yourselves. I am here to guide, direct, and facilitate. There will be some adjustment to this, as you learn to accept this responsibility and I learn to relinquish it. This is also very scary for me, because I can no longer control course content or anticipate your questions. I need to be prepared for anything, which is challenge me and take more time than the usual dry lecture class.

- *Payoff.* By the end, you will have truly mastered your subject. Many students may want to continue this work through a paper, thesis, or capstone experience.

Optional Text

Frederick S. Hillier and Gerald J. Lieberman. *Introduction to Operations Research.* McGraw-Hill, 2005, 8th edition.
   webpage: `http://highered.mcgraw-hill.com/sites/0073017795/information_center_view0/`

Course Requirements and Evaluation

- Course meets: MW 4:00-5:15

- Resource for Help with Course: professor's office hours, classmates, web

- Attendance: This problem-based learning class can not function unless every student is committed. One indication of commitment is class attendance and participation.

- Monthly Quizzes: In order to insure that students are exposed to and appreciate the many models used by other groups, there will be monthly quizzes on the basics of the mathematical modeling techniques. These are not as extensive or detailed as a test. They focus more on the "broad strokes" of the models.

- Final: There will be no final exam, instead a final report and presentation are required.

- Computing Software: Because we will be using large real world datasets supplied by our clients, we will use Matlab throughout the class.

- Grading scale: standard university scale

- Grading breakdown:

    - Quizzes (4) 20%
    - Weekly Presentations (10) 28%
    - Trimester Report (2) 16%
    - Trimester Presentation (2) 16%
    - Final Report (1) 10 %
    - Final Presentation (1) 10%

- Academic Integrity/Disability Services: University policies on academic integrity and disability services will be strictly enforced.