IOE 310 Syllabus

Instructor: Professor Katta G. Murty, 2773 IOE Bldg., 763-3513, katta_murty@umich.edu, **Office Hours:** Mon 2-3:30 PM, Wed 2-3 PM, and by appointment.

TA:

Prerequisites: An undergraduate course in linear or matrix algebra (Math 214 or Math 417 or equivalent).

Background Required: Elementary matrix algebra (concept of linear independence, bases, matrix inversion, Gauss-Jordan pivotal method for solving linear equations).

Course objectives: To provide the student with a basic understanding of optimization, its importance, and applications.

Webpage and Books to read
1: IOE 310 Webpage, notes at Instructor's URL: http://www-personal.engin.umich.edu/~murty/.
2: K.G. Murty, Operations Research: Deterministic Optimization Models, Prentice Hall, 1995.
3: F. S. Hillier, G. J. Lieberman, Introduction to Operations Research, Mcgraw Hill, 7th edition, 2001.
4: R. Fourer, D. M. Gay, and B. W. Kernighan, AMPL: A Modeling Language for Mathematical Programming, Scientific Press, 1993.

Acess to [2, 3] is very helpful. [4] is helpful if you choose to do the computer projects using AMPL.

Transparencies: The course will be taught using overhead transparencies in [1]. Registered students will have access to these transparencies through the WWW at the address given above.

[1] has descriptions of all the algorithms discussed in course, and homework problems. Examples will be worked out carefully in class.

Course Content

1. OR, Categories of optimization problems, their importance. Scoring method to find best among small number of alternatives. Greedy method and its drawbacks. (*Chapter 1 in [2], also read Chapters 1, 2 in [3] for history of OR, and the way OR approach solves problems*).

2. Early history of related topics. Review of Gauss-Jordan method of linear algebra. Linear programming as 20th century extension of linear algebra to handle linear inequalities. (*See "Self-teaching webbook on linear algebra" in Instructor's webpage.*)

3. Linear Programming models and their various applications (*Chapter 2 in [2], Chapter 3 in [3]*).

4. What useful planning information can be derived from an LP model (marginal values and their planning uses), special geometric methods for 2-variable LPs. (*Sections 2.8, 2.9 in [2]*).

5. Simplex method for LP. (*Chapter 4 in [3]*).

6. Duality, its economic interpretation, and optimality conditions for LP, marginal values from final output of simplex algorithm. (*Chapter 4 in [2]*).

7. Special version of simplex algorithm for transportation models. (*Chapter 6 in [2], Chapter 8 in [3]*).

8. Integer Programming models and their various applications, the branch and bound approach. (*Chapters 9, 10 in [2], Chapter 12 in [3]*).

9. Sequential decision models, dynamic programming, shortest chains in acyclic networks, the recursive method for simple resource allocation models. (*Chapter 12 in [2], Chapter 11 in [3]*).

10. The Critical Path Method for project management. (*Chapter 13 in [2], Chapter 10 in [3]*).

Work in the course: Weekly homework assignments. Computational projects to be solved and reports submitted on them. We encourage all students to learn AMPL software system (used by most companies now-a-days) to solve project problems. Students have the freedom to solve project problems using any software, but those using AMPL to solve them will get a higher grade.

Importance of attending classes: I expect all students to attend all the classes. Examples for all the algorithms discussed will be worked out in class, so if you miss one or more classes you will miss those examples and it will be difficult for you to catch up with the progress of the subject in the course.

Class courtesy: Pl. notify me (e-mail or a written note left in my mailbox) if you have to miss one or more classes for any reason.

Because the class size is large, it is very difficult to remember everyone's name. So, pl. help by remembering to introduce yourself (like this is "Jim Smith" etc.) everytime you ask a question. Thank you.

If something in the lecture is unclear, pl. ask questions then and there.

Diacussion of homework problems with others is fine, but you have to work out the final answers you are submitting, by yourself. **Late homeworks will not be accepted,** pl. do not request for delays in submitting homeworks or project reports.

Midterm 1 (in the class on 14 Oct. 01, 8:30 to 10:30 AM), **Midterm 2** (in the class on 7 Nov. 01, 8:30 to 10:30 AM), and **Final** (4 - 6 PM, 17 Dec. 01).

Both midterms will be held in the classroom, and an additional room.

Project reports due in class on 5 Dec. 01.

Approximate weights for determining final grade are: Homeworks (0.12), Midterms (0.19 each), Final (0.37), computer projects (0.13).