# OR 642: Integer Optimization

## GEORGE MASON UNIVERSITY

Systems Engineering and Operations Research Department

Spring, 2010

**Time:** Mondays, 4:30-7:10p.m; Innovation Hall 203
**Professor:** Steven Charbonneau
**Phone:** (703) 697-8651 (wk) from 8:30 am to 5:30 pm
(703) 550-5006 (hm) from 6:30 pm to 9:00 pm;
(703) 993-1521 (fax) at GMU SEOR office, ask them to hold it for me
**email:** scharbo2@gmu.edu
**Office hours:** by appointment

**Text:** Wolsey, L. Integer Programming Wiley, Interscience, 1998.

**Software:** You will use the MPL modeling language to complete your project. MPL is available free of charge for student use. Go to Maximal Software (www.maximal-usa.com) to download the latest version of the software. More detailed instructions on downloading the software and getting the license set up will be provided in class.

**Course Description:** This course is designed to introduce discrete optimization models and to provide the mathematical foundations of integer and combinatorial optimization models along with the algorithms that can be used to solve such problems. Some problem areas discussed are planning models such as capital budgeting, facility location and portfolio selection, design problems such as telecommunication and transportation network design, VLSI circuit design and the design of automated production systems, and real-time operational models such as real-time dispatching and scheduling, made-to-order production models, and real-time satellite scheduling and maneuvering. Examples from statistics, economics, politics and mathematics will also be presented. Polyhedral theory necessary to understand the new techniques will be covered in some detail, as will column-generation approaches.

A lesson plan is provided below. This plan will change based on time limitations and the interests of the students. Although the text required will be used as much as possible, much of the material will be presented through readings, course notes and power-point presentations.

**Course Outline:**

Lesson 1 (Jan 25th): Introduction and Model Formulation I *(Read Wolsey, Chapter 1)*

Lesson 2 (Feb 1st): Model Formulation II *(Review Wolsey, Chapter 1)*

Lesson 3 (Feb 8th): LP Review

Lesson 4 (Feb 15th): Branch and Bound *(Read Wolsey, Chapter 7)*

Lesson 5 (Feb 22st): Preprocessing Models

Lesson 6 (Mar 1st): Relaxations *(Read Wolsey, Chapter 2)*

Lesson 7 (Mar 15th): Using MPL (ensure MPL is downloaded on your laptop and working)

Lesson 8 (Mar 22th): Mid-term Exam

Lesson 9 (Mar 29nd): Cutting Planes I *(Read Wolsey, Chapter 8)*

Lesson 10 (Apr 5th): Cutting Planes II *(Review Wolsey, Chapter 8)*

Lesson 11 (Apr 12th): Decomposition

Lesson 12 (Apr 19th): Column Generation *(Read Wolsey, Chapter 11)*

Lesson 13 (Apr 26th): Heuristics I *(Read Wolsey, Chapter 12, Projects Due)*

Lesson 14 (May 3rd): Heuristics II *(Review Wolsey, Chapter 12)*

**Grading Scheme:**

Homework: 20%
Midterm Exam: 25%
Project: 20%
Final Exam: 35%

**Additional Notes:**

Mid-term exam will be an in-class exam. The final exam will be a take-home exam. In class exams will be open book and open notes.

There will be a class project. Students may work in pairs or individually.

Best way to contact the professor is by email.