OR 642: Integer Optimization
GEORGE MASON UNIVERSITY
Systems Engineering and Operations Research Department
Spring, 2012

Time: Tuesdays, 4:30-7:10p.m; West 1001
Professor: Karla Hoffman
Phone: (703) 993-1679
(703) 993-1521 (fax) indicate that it is for Karla Hoffman
email: mailto:khoffman@gmu.edu (best way to reach me most of the time)

Office hours: Mondays/Tuesdays 2:00pm-3:00pm and by appointment
With notice, I am available after class on Tuesdays

Text: Applied Integer Programming
Authors: Der-San Chen, Robert G. Batson, and Yu Dang
Publisher: Wiley 2010

Software: The course requires that you use a modeling language to complete your project. MPL is the preferred language, but you can use AMPL, GAMS or AIMMS if you feel that you are sufficiently proficient in that language to debug any problems without my help. MPL is available free of charge for student use from Maximal Software. 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. The course will combine modeling, algorithmic developments and the use of commercial software. The problem areas discussed will include both planning models such as capital budgeting, facility location and portfolio selection, and design problems such as telecommunication and transportation network design, VLSI circuit design and the design of automated production systems. Examples from statistics, economics, politics and mathematics will also be presented. Heuristic algorithms, cutting-plane methods, decompositions and tree search will be covered in detail. A tentative outline of the topics is provided below. This outline can change based on time limitations and the interests of the students.

Goals for the Course: By the end course, you should be able to:
- Given an optimization problem, formulate an appropriate integer linear model
- Understand the basic mathematical structure of the model
- Understand the techniques that could be used to solve the model.
- Understand how to use a modeling language and/or commercial solver to solve the model.

- Understand the limitations of "off the shelf" solvers and how to tune their parameters to improve performance.

Blackboard: Lecture notes, presentations, and assignments will be found on blackboard. The location for blackboard is mymason.gmu.edu. This site is password protected, and uses the same identification as your gmu email account.

EMAIL: I will communicate with the class through email, so please make sure that your gmu account is current and working! This is especially important since Blackboard will only function if you have a working email account and are registered for the course.

Course Outline

Lesson 1 (Jan 24th):   Introduction and Model Formulation I
      (Read textbook, Chapters 2 and 3)
Lesson 2 (Jan 31st):   Model Formulation II *(Read textbook, Chapter 5 &6)*
Lesson 3 (Feb 7th):   Preprocessing of Integer Programming Models
      (*Read textbook, Chapter* 4)
Lesson 4 (Feb 14th):   Review of Linear Programming (*Read textbook, Chapter 9)*
Lesson 5 (Feb 21st)   Relaxations and Branch and Bound *(Read Wolsey, Chapter 11)*
Lesson 6 (Feb 28th):   Using MPL (ensure MPL is downloaded on your laptop and working)
Lesson 7 (Mar 7th)   Mid-term Exam
Mar 14th   NO CLASS – Spring Break
Lesson 8 (Mar 21st):   Introduction to the geometry of integer problems and polyhedral
      theory *(Read textbook, Chapter 8)*
Lesson 9 (Mar 28th):   Cutting Planes I *(Read textbook, Chapter 12)*
Lesson 10 (Apr 4th):   Cutting Planes II *(Read textbook, Chapter 11)*
Lesson 11 (Apr 11th):   Heuristics *(Read textbook Chapter 14 and handout)*
Lesson 12 (Apr 18th):   Understanding the parameter settings in an integer programming
      package (**NOTE:** ***Projects Due Today***)
Lesson 13 (Apr 25th):   Column Generation *(Read Wolsey, Chapter 11* **NOTE:** *Projects Due Today)* Lesson 12 (May 2nd):   Review *(Read Wolsey, Chapter 11)*
Lesson 14 (May 2nd)   Review

FINAL EXAM: TAKE HOME. DUE May 9th.

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.

University Policies

Academic Integrity

Mason is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

Mason Email Accounts

Students must use their MasonLIVE email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

Office of Disability Services

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu

Other Useful Campus Resources

WRITING CENTER: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu

UNIVERSITY LIBRARIES "Ask a Librarian"
http://library.gmu.edu/mudge/IM/IMRef.html

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): (703) 993-2380;
http://caps.gmu.edu

University Policies:

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu. All members of the university community are responsible for knowing and following established policies.