BMGT 833
INTEGER PROGRAMMING
Spring, 2005

VMH 1415; Monday 3:30 – 6:10PM

Instructors: Prof. Michael Ball, mball@rhsmith.umd.edu, 301-405-2227, VMH 4471
Prof. Zhi-Long Chen, zchen@rhsmith.umd.edu, 301-213-0591, VMH 4317
Office hours: Ball & Chen, Monday 2:30 – 3:30PM
TA: Yingjie Lan, yingjie_lan@rhsmith.umd.edu

This course gives a rigorous treatment of integer and combinatorial optimization. All aspects of the subject area will be discussed, including problem formulation, underlying mathematical theory and solution algorithms. Emphasis will be given to the many new and exciting developments in this field, including recent results in reformulation strategies and preprocessing, polyhedral combinatorics, Lagrangian relaxation and column generation approaches, etc. The prerequisites are a solid course in linear programming such as BMGT 830 and a reasonable level of mathematical sophistication.

Text: L.A. Wolsey, *Integer Programming*, Wiley, New York, 1998. ISBN: 0 –471-28366-5.

Requirements:

- Homeworks 20%
- Midterm exam 25%
- Final exam 35%
- Team Project & Presentation 20%

Homeworks: This is a problem solving courses. The best way to learn the material is to practice solving problems and the homeworks are a primary vehicle for doing this. Homeworks will be graded as follows. A grade of +1, 0 or -1 will be assigned with the following interpretation:

+1: good attempts on nearly all problems; most problems largely correct.
0: good attempts on most problems; some problems largely correct.
-1: largely incorrect (includes no homework).

Homework collaboration: Students may discuss homework problems outside of class and help each other in finding approaches to the solution of problems. ***However, each student must hand in a solution that represents their own final work and calculations.***

Some of the homework problems will require computational experiments with an integer programmer solver. An initial assignment using Excel Solver will be given. Later assignments will require a more powerful solver. Students can download a free student version of the software XPRESS at www.dashoptimization.com. Students can also access XPRESS in the E-Markets Lab (VMH 3518). Other software, e.g. CPLEX, can also be used if students have the access.

Team Project & Presentation: There will be a team project. Each team can have up to 2 students. A list of papers from recent literature will be given. Each team will pick one paper from the list, understand the problem(s) and solution algorithm(s) given in the paper, then develop a

new algorithm and implement it. Each team will make a presentation of their project in the last two weeks of the course. Each presentation will last approximately 30 to 45 minutes.

Exams: There will be a closed-book midterm exam, and an open-book final exam, which will be cumulative.

Course Website: Log in to the Blackboard course web site through http://bb.rhsmith.umd.edu. Necessary course documents (handouts, notes, etc.) will be posted there. Also there will be a discussion board on questions related to homeworks and lectures. Use this discussion board to post your questions. This will be the easiest and fastest way for the instructors and TA to respond to your questions.

Academic Integrity: The University's *Code of Academic Integrity* is designed to ensure that the principles of academic honesty and integrity are upheld. All students are expected to adhere to this Code. The Smith School does not tolerate academic dishonesty. All acts of academic dishonesty will be dealt with in accordance with the provisions of this Code. Please visit the following website for more information on the University's Code of Academic Integrity: http://www.inform.umd.edu/CampusInfo/Departments/JPO/AcInteg/code_acinteg2a.html

Special Needs: Any student with special needs should bring this to the instructor's attention as soon as possible, but no later than the second week of class.

COURSE OUTLINE

Students should read the relevant chapters prior to the lecture in which they are used.

Date	Topics	Chapters	Instructor
1/31	Introduction to IP; formulating IP's	1	Prof. Ball
2/7	Optimality, relaxation, and bounds	2	Prof. Ball
2/14	Well-solved problems; matching & assignment	3, 4	Prof. Ball
2/21	Computational complexity; problem reductions	6	Prof. Chen
2/28	Branch and bound; preprocessing	7	Prof. Chen
3/7	**Midterm Exam (3:30 – 4:45)** Simple valid inequalities (5:00 – 6:10)	8	Prof. Ball
3/14	Cutting plane algorithms	8	Prof. Ball
3/21	**Spring Break. No Class**		
3/28	Polyhedral theory; strong valid inequalities	9	Prof. Ball
4/4	Branch and cut algorithms Lagrangian relaxation	9 10	Prof. Ball Prof. Chen
4/11	Lagrangian relaxation & Lagrangian duality	10	Prof. Chen
4/18	Column generation; Benders decomposition	11	Prof. Chen
4/25	Heuristic algorithms	12	Prof. Chen
5/2	**Student presentations**		
5/9	**Student presentations; course evaluation**		
TBD	**Final Exam**		