

EBGN657 - Advanced Integer Programming

Fall 2012

Lectures	Tuesday, Thursday	8:00am - 9:15am	211 Engineering Hall
Instructor	A. M. Newman		
	Office:	319 Engineering Hall	
		Tuesday	12:30pm- 2:30pm
		Wednesday	5:00pm-8:00pm
	email:	newman@mines.edu	
Teaching Assistant (TA)	Greg Steeger		
	Office:	125 Engineering Hall	
	Office Hours:	Tuesday	9:30am-10:30am

GENERAL INFORMATION

- **Textbooks:**

- ★ R. Rardin. *Optimization in Operations Research*, Prentice Hall, 1998 (optional).
- ★ Fourer, Gay, Kernighan. *AMPL: A Modeling Language For Mathematical Programming*, Thompson, 2003 (optional).
- ★ Martin. *Large Scale Linear and Integer Optimization*, Kluwer Academic Publishers, 1999 (optional).

- **Assignments:** There will be a weekly assignment due on Thursday in class the following week.
- **Project:** There will be a project involving formulating, solving and analyzing a challenging problem, writing code, and/or performing a literature review. The project group may consist of between one and four students. The project will be due during finals week. If you have a research project, the project will concern some aspect of your research.
- **Exams:** There will be a midterm and a final examination. Both are open book. You must wait 48 hours after the exam has been handed back to ask (me) any grading questions.

- **Grading:**

- ★ Class Participation: 5%
- ★ Homework Assignments: 20%
- ★ Project: 25%
- ★ Midterm: 20%
- ★ Final: 30%

Grading is done on a curve where 90% is sufficient but not necessarily necessary for an A-, 80% is sufficient but not necessarily necessary for a B-, etc.

COURSE OUTLINE

- **I. Integer Programming Formulations**

- ★ Topics will be determined based on the background and interest of the class, but will involve at least one military model, one energy model (REOpt), and one mining model (the transition model), and will consist of examining code in each of the modeling languages AMPL, GAMS and Mosel.

- **II. Good Integer Programming Formulations**

- ★ Removing complexities
 - Linearization
 - Symmetry elimination
 - Variable elimination
 - Modeling with persistence
- ★ Emphasizing problem structure
 - Variable definition
 - Special ordered sets
- ★ Adding strength to bounds: MIP cuts
 - Clique cuts
 - Cover cuts
 - Mixed integer rounding cuts
 - Gomory cuts

- **III. Rounding Heuristics**

- **IV. Constraint Programming**

- **V. Benders Decomposition**

- ★ Problem structure and decomposition, master and subproblems
- ★ Implementation in a scripting language and performance

RULES

- Statute of limitations for questions about grading is one week from the student's receipt of the graded work.
- All cell phones must be turned off during class. (NB: This means no text messaging.)
- No rudeness of any kind towards anyone in the class will be tolerated.
- Do not talk to your neighbor during class.
- You may confer with others regarding the homework and project, but the work you hand in must be your own. Please ensure it is done neatly.
- Attendance in class is required. Be on time.
- Any alternate arrangements for exams must be submitted in writing at least one week in advance of the exam. Any additional arrangements regarding disabilities must be *formally* and *legally* documented and approved.

A minor infraction of the above rules will result in a warning. A major infraction will result in expulsion from the class.