Department of Systems Engineering Operations Research
GEORGE MASON UNIVERSITY
OR 782: Advanced Topics in Combinatorial Optimization

Time: Tuesdays, 4:30-7:10p.m; Nguyen Engineering Building 1108
Instructor: Professor Karla L. Hoffman
Office of Instructor: Nguyen Engineering Building, Room 2207
Phone of Instructor: (703) 993-1679
Office hours: Tuesdays: 1:00-3:00p.m.and by appointment

I am usually on Tuesdays and Thursdays from 9:30 to 6:30. I can also be available after class on Tuesday.

Text: Laurence A. Wolsey *Integer Programming*, John Wiley & Sons 1999.
Alternative text: Nemhauser and Wolsey *Integer and Combinatorial Optimization* John Wiley and Sons, 1985

Course Materials: All course materials will be located at: mymason.gmu.edu

To access these course materials, you will need to have registered for the course and have an active email account at GMU. You will log onto the blackboard site by using your email address name and password.

This course is designed to cover advanced topics in combinatorial optimization. The course will stress the explosion of new algorithmic results and their relationships to solving very large-scale integer programming problems. We will use the advanced routines within both the CPLEX optimization package and the GUROBI optimization package to implement some of these ideas. All software is available free-of-charge for academic use. We will likely work in python or Java (or if you prefer C or Julia, that too is possible).

Topics to be discussed will be recent heuristics developed for difficult combinatorial problems (e.g. linear-programming-based algorithms, tabu search, evolutionary algorithms), new decomposition and variable splitting techniques, column generation techniques and the importance of new linear and semi-definite optimization techniques as they impact combinatorial problems. The course will require each student to read current research papers on a specific topic area (either an application area or on algorithmic development) and provide both a written and oral presentation on the results of this literature survey. If the class is interested, we can also develop within the Optimization Programming Language (OPL) constraint programming approaches toward obtaining good feasible solutions to hard optimization problems.

Proposed Topics:
Understanding Options of Optimizers and Use of Callback Procedures within software
Combinatorial Auctions
Details of the traveling salesman problem and related routing problems
Decomposition techniques for solving difficult optimization problems
- A. Benders Decomposition
- B. Dantzig-Wolfe Decomposition
- C. Lagrangian Decomposition, Variable-splitting and Duality

Recent advances in constraint programming and its effects on solvability of integer programming problems
Topics chosen by class.

Grade will be based on: Homework assignments 25%
Written paper 25%
Class presentation 30%
Participation in class 20%