Discrete Optimization
SM421, Fall 2010

Syllabus

Instructor: D. S. Altner
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Textbook: Winston and Venkataramanan, *Introduction to Mathematical Programming*

Prerequisite: SA401 Linear Programming

COURSE OVERVIEW

This is a continuation of SA401 Linear Programming that focuses on discrete optimization. *Discrete optimization* is the term for a broad class of optimization methodologies including network programming (i.e., formulating and solving problems on networks), integer programming and combinatorial optimization (i.e., optimization problems with a finite number of feasible solutions.)

PART I: Graph and Network Algorithms

In this part of the course, we will cover many graph and network-based algorithms for several widely studied problems in operations research, including the Minimum Spanning Tree Problem, the Maximum Weight Bipartite Matching Problem, the Stable Marriage Problem and the Minimum Cost Network Flow Problem. We will also discuss applications of these problems including those in sports scheduling and sweeping streets for IEDs.

PART II: Integer Programming: Modeling and Algorithms

In this part of the course, we will cover numerous integer programming modeling techniques for problems that arise in a variety of applications. We will also cover basic methods for solving integer programs such as the branch-and-bound method as well as methods for solving integer programs with a “very large” number of structured constraints, such as the traveling salesman problem.

PART III: Integer Programming Software

In this part of the course, we will learn how to use an advanced modeling language (MPL) and an advanced integer programming solver (GLPK). MPL is a commonly used modeling language by operations research analysts that is more conducive to formulating

much more complex problems than Excel Solver. The GLPK solver is also freely available and is capable of solving much more difficult integer programs than Excel Solver.