

CSI 5166 Winter 2017

CSI 5166

APPLICATIONS OF COMBINATORIAL OPTIMIZATION

Topics in combinatorial optimization with emphasis on applications in Computer Science. Topics include network flows, various routing algorithms, polyhedral combinatorics, and the cutting plane method.

PROFESSOR:

Dr. Sylvia Boyd
STE 5106
Office Hours: Tuesday 13:30 – 15:00
Email: sylvia@site.uottawa.ca

TIME AND PLACE:

Tuesday 11:30-13:00 STE F0126
Friday 13:00-14:30 STE F0126

COURSE WEB PAGE: <http://www.site.uottawa.ca/~sylvia/csi5166web/index.htm>
(course information will be posted here)

CLASS NOTES: Provided by email and/or on website.

TEXTBOOK: None required, but a good reference is Combinatorial Optimization, by Cook, Cunningham, Pulleyblank and Schrijver.

COURSE EVALUATION

In class tests (4)	50%
(Dates: Jan. 20, Feb. 10, Mar. 10, Mar. 31)	
Presentation	15%
Final exam (closed book)	35%

COURSE OBJECTIVES

The field of combinatorial optimization deals with discrete optimization problems. The problems and methods of this field have many applications in Computer Science and Engineering (communication protocol testing, network reliability, file storage, robotics, ...) and industry (printed circuit board production, scheduling, vehicle routing...). The objective of this course is to teach a variety of classical methods and problems from this field as well as the theory behind these methods. It is hoped that by the end of the course you will understand these techniques and models and the theory behind them well enough that you will be able to apply them if and when the opportunity arises in your future research endeavors and careers.

COURSE OUTLINE

- Introduction to course and samples of combinatorial optimization problems and their applications.
- Background information: graph theory, linear and integer programming models, overview of methods used for solving combinatorial optimization problems.
- Paths and trees: Quick review of minimum cost spanning trees and Dijkstra's algorithm for shortest paths (for non-negative weights), shortest path algorithms for general weights.
- Routing problems: Eulerian graphs, the Chinese postman problem, the rural Chinese postman problem.
- Network flows: Various models, methods, applications.
- Methods for finding exact or provably good solutions for NP-hard problems: approximation algorithms, lower bounds, polyhedral combinatorics, branch and cut. Applications of these methods to the Travelling salesman problem, and the minimum weight k-connected subgraph problem.
- Assignment problems and matchings.
- Introduction to matroids (if time).

SOME SPECIAL IMPORTANT NOTES

- Taking photographs or videos during class is **strictly prohibited**.
- All materials prepared by the course professor, including lab manuals, class handouts and test papers, are **copyright**. Copying or scanning them or posting them on a website is therefore **a violation of copyright and is illegal**.