CS 491 - Combinatorial Optimization

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1 Preview

This course is intended to cover various aspects of combinatorial optimization as they relate to network optimization problems. It is targeted towards graduate students in Computer Science, Mathematics, Industrial Engineering and Economics; however any student with a reasonably strong mathematical background can succeed.

2 Pre-requisites

A course on Analysis of Algorithms and exposure to Linear Algebra.

3 Schedule

14 weeks of Summer I and Summer II, with two lectures per week. You need to register for Summer II only.

4 References

Most of the material will be from [CCPS98], which will serve as the course text. One lecture on Approximation algorithms will be covered from [KV00].

5 Syllabus sketch

1. Optimal Paths and Trees - Minimum Spanning Trees and Shortest Path Trees (2 Lectures)
2. Maximum Flow - Network Flow, Max flow, Min Cut, Multi-commodity flows (6 Lectures)
3. Minimum-Cost Flow - Primal algorithms, Dual Algorithms, Dual Scaling (4 lectures)
4. Optimal Matchings - Alternating Paths, Maximum matching, T-Joins and Postman problems (6 Lectures)
5. Matroids - The Greedy algorithm, Unweighted matroid intersection, weighted matroid intersection (6 Lectures)
6. Integrality of Polyhedra - Hulls, Facets, Total Unimodularity, Total Dual Integrality (3 Lectures)
7. Approximation Algorithms - Basic Concepts (1 Lecture)

6 Grading

1. Lecture Notes (10 %)
2. Midterm (20 %)
3. Final (20 %)
4. Project (50 %)

References

[CCPS98] William Cook, William H. Cunningham, William Pulleyblank, and Alexander Schrijver. *Combinatorial Optimization.* John Wiley & Sons, 1998.

[KV00] B. Korte and J. Vygen. *Combinatorial Optimization.* Number 21. Springer-Verlag, New York, 2000.