

# CMSC 858Y: Combinatorial Optimization: Algorithms and Complexity Spring 2010

**Course Information:** <http://www.cs.umd.edu/~samir/858/>

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**Class Time:** MonWed 3:30-4:45pm. CSIC 3120.

**Course Overview:** The main paradigm in the course will be the design and analysis of algorithms for combinatorial optimization. We will cover problems that can be solved optimally in polynomial time (matchings, flows, min-cost flows) as well as study problems that are NP-hard, and for which we can develop approximation algorithms. Small changes in problem definition often change the complexity of a problem from being solvable optimally in polynomial time to being NP-hard. Why does this happen? This course will shed some light on this phenomena.

I expect that the students are already familiar with the material from CMSC 451 (minimum spanning trees, shortest paths, dynamic programming, NP-completeness etc.).

The following broad aims will be attempted.

- Learning about efficient algorithms for basic problems that are used as building blocks elsewhere. These include matching, flow, min cost flows, primal-dual methods, LP-rounding etc.
- An understanding of the inherent complexity of problems: Polynomial time, NP-completeness, Approximation Algorithms etc. We will spend a large fraction of the semester studying techniques for designing approximation algorithms. Many of these involve fairly mathematical proofs.

**Primary Reference Text:** Approximation Algorithms by *Vijay Vazirani*.

*References:*

Dorit Hochbaum (editor), *Approximation Algorithms for NP-hard problems*, PWS publishing company (1996).

Christos Papadimitriou and Ken Steiglitz, *Combinatorial Optimization: Algorithms and Complexity*.

**Prerequisites:** CMSC 451 or an equivalent course. I expect familiarity with NP-completeness. Please read the appropriate chapter in CLRS if you have not done so.

**Course Work:** Course work will consist of two in-class exams (75 mins each). There will be several ungraded homeworks during the semester.

If you cannot come to class, please ask a friend to pick up copies of handouts from you. **It is your responsibility to make sure that you pick up all handouts.**

**Grading:** Grades will be based on the two exams. The relative weights of these will be 50% for each exam.