Course Outline — SPRING 2015

MATH 482

COMBINATORIAL OPTIMIZATION

Sections C13 C14, 10AM MWF, Room 141 Altgeld Hall
Instructor: Theo Molla, 226 Illini Hall, molla@illinois.edu
Office hours: 3 - 4:30 MW or by appointment
Webpage: `http://www.math.uiuc.edu/~molla/2015_spring_math482`
Final exam: 7:00-10:00 PM, Tuesday, May 12

In this course, we study mathematical aspects of problems in linear and integral optimization that are relevant in computer science and operation research. The course is based on the book *Understanding and Using Linear Programming* by J. Matoušek and B. Gärtner.

We start by describing and analyzing the simplex algorithm for linear programming. Next we discuss the geometric concepts underlying the algorithm and start the main theme of the course— duality. Using this idea we give some modifications of the simplex method and analyze their computational aspects.

We introduce the primal–dual algorithm and show what its variations can do for some of the basic problems in combinatorial optimization: the shortest path problem, the max-flow problem, the min-cost flow problem. Then we discuss some applications of the above material to matrix games and combinatorial min-max theorems. After that, we describe what can be done for integer linear programs (such as Traveling Salesman Problem or scheduling problems).

If time permits, we will also discuss *matroids* —a notion important in combinatorial optimization, and we will introduce some ideas of dynamic programming and branch-and-bound.

Requirements: At least 11 problem sets (the ten highest homework grades count), 5 short quizzes, three tests and a final examination.

Weighting: Problem sets $20 \times 10 = 200$ points, tests $100 \times 3 = 300$ points, final exam 200 points, quizzes 25 points, total 725 points. The grading scale is: $A \geq 655$ points, $A^- \geq 630$ points, $B^+ \geq 605$ points, $B \geq 580$ points, $B^- \geq 555$ points, $C^+ \geq 530$ points, $C \geq 505$ points, $C^- \geq 475$ points, $D^+ \geq 450$ points, $D \geq 425$ points, $D^- \geq 400$ points.

Prerequisite: Math 415 or equivalent