Course Outline — FALL 2015

MATH 482

LINEAR PROGRAMMING

Sections D13 D14, 11AM MWF, Room 345 Altgeld Hall
Instructor: Theo Molla, 226 Illini Hall, molla@illinois.edu
Office hours: 2:30 - 4:00 MW or by appointment
Webpage: `http://www.math.uiuc.edu/~molla/2015_fall_math482`
Final exam: 1:30-4:30 p.m., Thursday, December 17

In this course, we the study mathematical aspects of problems in linear and integral optimization, which are relevant in computer science and operation research. The course is based on the book *Combinatorial Optimization: Algorithms and Complexity* by C. Papadimitriou and K. Steiglitz. Some additional material will be from the following two books (which are not required): *Understanding and Using Linear Programming* by J. Matoušek and B. Gärtner (you can access a free, electronic version via the library's website) and, to a lesser extent, *Linear Programming* by V. Chvátal.

We start with examples of linear programs and some of fundamental theorems of linear programming. We then describe and analyzing the simplex algorithm for linear programming. We then discuss duality, which is one of the main themes of the course. Using this idea, we will present some modifications of the simplex method and analyze their computational aspects.

We introduce the primal–dual algorithm and how it can be applied to some of the basic problems in combinatorial optimization, e.g. the shortest path problem, the max-flow problem and 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 some techniques for solving integer linear programs (such as Traveling Salesman Problem or scheduling problems).

If time permits, we will introduce some ideas of dynamic programming and branch-and-bound. We may also discuss the ellipsoid method and interior point methods for solving linear programs.

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 (90%), $A^- \geq 630$ points (87%), $B^+ \geq 605$ points (83%), $B \geq 580$ points (80%), $B^- \geq 555$ points (77%), $C^+ \geq 530$ points (73%), $C \geq 505$ points (70%), $C^- \geq 475$ points (66%), $D^+ \geq 450$ points (62%), $D \geq 425$ points (59%), $D^- \geq 400$ points (55%).

Prerequisite: Math 415 or equivalent