Course Syllabus OIDD 916, spring 2018.

Textbook

The textbook used is “Integer Programming”,

by M. Conforti, G. Cornuejols and G. Zambelli, Springer.

Additional reading material will be distributed during the semester.

List of topics to be covered (among others):

Course overview. Examples of problems with large integrality gaps, and with feasible rounded solutions yielding large relative gaps.

Review of LP duality, and of the primal and dual simplex methods, with emphasis on re-optimization after the addition of violated cuts. The dual simplex method for LPs with upper bounds. Additional readings:

http://iems.northwestern.edu/~4er/WRITINGS/index.html#dual


Branch-and-bound and enumeration. Driebeck penalties, Tomlin penalties.

0-1 knapsack problems. Their LP solutions. BB. Cover inequalities.


Dantzig-and-Wolfe decomposition algorithm, solution of the Lagrangean dual by column generation: example of the multi-item capacitated lotsizing problem and the GAP.

Valid inequalities. Chvatal-Gomory procedure.
Linear programming relaxation and Gomory cuts for pure and mixed-integer problems.

**Lifting**, covers, lifted covers.

**Modeling** integer programming problems: choice of decision variables and of constraints, simple strengthening techniques. Examples: SPLP, CPLP, lotsizing, with and without disaggregation. Integrality gaps. Model tightening (see paper). (throughout the semester)

**Variable fixing**, cliques and implication tables, probing.

Total **unimodularity**. Relationship with integer feasible solutions for integer programming problems. Special cases of network flow problems.


**Other relaxations**. Surrogate relaxation and surrogate duals

**Applications**: airline crew scheduling, lotsizing, facility location, production scheduling... (throughout the semester).