COMP 567 – Discrete Optimization 2
Course Content

General

This course covers the formulation and solution of integer programs and looks at their application to a wide range of problems in operations research and combinatorial optimization. Integer programs are used to model situations where some of the variables are indivisible, for example 0/1 variables, which model yes/no decisions. Typical applications include scheduling problems, vehicle routing, telecommunication networks, electricity generation, cutting stock problems, and mine production planning.

Content

Week 1
- Introduction
  - Introduction to discrete optimization (Components of a mathematical model, linear programming models, integer programming models, MIPs, other)
  - Classical problems in discrete optimization (knapsack, assignment problem, TSP, other)

Week 2
- The simplex method (the algorithm, outcomes, cycling and degeneracy)
  - Duality (Dual formulation, Duality theorems, some uses of duality)

Week 3
- Initial presentations
  - Dual simplex method

Week 4
- Relaxations (motivation, definition, linear relaxation)
  - Gomory’s cutting plane methods

Week 5
- Branch and Bound (the algorithm, branching strategies, node selection)

Week 6
- Restriction approach
  - Dantzig-Wolfe decomposition method and column generation

Week 7
- Relaxation approach
  - Benders decomposition

Week 8
- Initial project presentations

Week 9
- Stochastic integer programming

Week 10
- Advanced aspects of stochastic integer programming
Week 11
- Metaheuristics: Local search methods (descent, Tabu search, simulated annealing, variable neighborhood search)
- Adaptive large neighborhood search

Week 12
- Metaheuristics: Population based methods (Genetic algorithm, Scatter Search, particle swarm)

Week 13
- Final project presentations

Other:
- Final examination and a substantial project (teams of 2 persons)

Textbooks:
- Linear programming, V. Chvatal, 1983
- Introduction to Stochastic Programming, Birge and Louveaux, 2011