Syllabus:

Shortest paths and labeling algorithms; multi-commodity flows (and differences to the min-cost problem); decomposition techniques (dantzig-wolfe decomposition etc.); Lagrangean relaxation; set-covering and set-partitioning problems and special characteristics; column generation (relation to duality) and branch-and-price; branch-and-price and cut; composite variable modeling; Composite variables and branch-and-price-and cut; Vehicle routing and some cuts for vehicle routing (perhaps include some metaheuristics); modeling robustness and uncertainty; stochastic modeling in large-scale integer programs; data-driven optimization. The course will include real-world modeling examples from applications including vehicle routing, freight logistics, airline schedule planning, etc. Homeworks will incorporate real data extracted from consulting case-studies and students will be implementing models in Java/C++ and CPLEX.

Textbooks:

1. Ahuja Magnanti Orlin
3.

Lecture 1:

Shortest paths and labeling algorithms

Lecture 2:

Linear programming – dual, reduced costs, etc.

LP/IP; Branch-and-bound

Depth-first-search; breadth-first-search

Lecture 3:

Min-cost flows? - Delete

Multi-commodity flows

- Dantzig-Wolfe decomposition
- Other decomposition methods
Lecture 4:
Lagrangean Relaxation
Dantzig-Wolfe
Benders decomposition?

Lecture 5:
Price of anarchy
Variational inequalities
Randomized algorithms

Lecture 6: