

# COMBINATORIAL OPTIMIZATION

6 CFU

Semester: II

SSD: MAT/09

Codice Insegnamento: ??

Giovanni RIGHINI

## Programme

The course presents the main algorithms and techniques to compute optimal solutions to combinatorial optimization problems with special emphasis on graph optimization. The students will develop experimental activities with the algorithms described during the course.

- **Graphs, definitions and properties.**
- **Problems of minimum cost connectivity.** Minimum cost spanning tree: Kruskal, Prim, Boruvka algorithms. Minimum cost spanning arborescence: Edmonds algorithm.
- **Shortest path problems.** Unweighted graphs: BFS algorithm. Weighted acyclic graphs: Critical Path Method. Graphs without negative cost cycles: Bellman-Ford algorithm. Graphs without negative cost arcs: Dijkstra algorithm. Floyd-Warshall algorithm for the computation of the all-pairs shortest paths matrix on a weighted digraph.
- **Optimal flow problems.** Ford-Fulkerson algorithm for the maximum flow problem and its implementations. Algorithms for the maximum flow minimum cost problem. Duality: max flow - min cut theorem. Gomory and Hu algorithm for finding a minimum cut in a weighted graph.
- **Bipartite matching problems.** The Hungarian algorithm.
- **Minimum cost transportation problems.** Dantzig algorithm.

## Materiale di riferimento

R.K. Ahuja, T.L. Magnanti, J.B. Orlin "Network flows", Prentice Hall, 1993

## Materiale consigliato

Slides and papers available on the course website

## Prerequisiti

Algorithms and data-structures. Computer programming. Linear Programming. English.

## Modalità di valutazione

Project.

## Incompatibilità con altri insegnamenti

None

**Pagina web del corso:** <http://www.di.unimi.it/righini/Didattica/>