

Graph theory and algorithms

Instructor: Péter Csikvári

Term: Fall

Weeks: 1-7

Contact hours: 3

Credits: 6

Aim and scope:

The goal of this course is to give a very concise introduction to graph theory with an emphasis on the basic concepts, algorithms and ideas.

The theoretical background is supplemented by weekly practices in Python (Sagemath).

Syllabus:

Graphs and directed graphs, bipartite graphs, degree of a vertex, handshake lemma
Connectedness, connected components, spanning trees, paths and distances in graphs
Cliques and colorings.

Basic algorithms. Breadth-first search tree. Minimum weight spanning tree. Finding shortest path in a graph, Dijkstra's algorithm.

Matchings, Hall-theorem for matchings in bipartite graphs, matchings in non-bipartite graphs, stable matchings

Algorithms, Turing machine, computational complexity, P vs NP, reductions of algorithmic problems

Adjacency matrix, eigenvalues of graphs

Grading: exam (incorporating the solution of homeworks)

Literature:

S. Even: Graph algorithms, Cambridge University Press, 2nd edition, 2012.

J.A. Bondy, U.S.R. Murty: Graph Theory, Springer Graduate Texts in Mathematics, 2010