



Engineering studies in IT - międzynarodowy program studiów
prowadzonych przez Wydział Matematyki i Informatyki UAM w Poznaniu
Nr projektu POWR.03.03.00-IP.08-00-MPK/16

TOPICS IN GRAPH THEORY

Learning module description

GENERAL INFORMATION

1. Module title: Topics in graph theory
2. Module code: DTGT LI0-E
3. Term: summer
4. Duration: 30h lectures + 30h laboratories
5. ECTS: 6
6. Module lecturer: Yanbo Zhang
7. E-mail: yanzha@amu.edu.pl
8. Language: English

DETAILED INFORMATION

1. Module aim is to familiarize students with the basic concepts, properties and approaches in graph theory, as well as its applications in computer science.
2. Pre-requisites in terms of knowledge, skills and social competences (where relevant):
Knowledge of basic linear algebra and set theory.

SYLLABUS:

- Week 1: Graphs. Graph isomorphism. The adjacency and incidence matrices. Degree.
- Week 2: Subgraphs. Special graphs. Walks, paths and cycles. Connectivity. Connected component.
- Week 3: Complement graph. Clique. Independent set. Trees. Equivalent definitions of trees. Kruskal's algorithm. Dijkstra's algorithm.
- Week 4: Cayley's formula. Prüfer code algorithm. Directed graph.
- Week 5: Vertex connectivity. Cut vertex. k -connected. Edge connectivity. k -edge-connected. 2-connected graphs. Breadth-first search. Depth-first search.
- Week 6: Menger's theorem. Global version of Menger's theorem.
- Week 7: Eulerian trails and tours. Euler's circuit theorem. Eulerian circuit algorithm in digraph. Hamilton paths and cycles.
- Week 8: Dirac's theorem. Ore's theorem. Matchings. Real-world applications of matchings. Augmenting path algorithm.
- Week 9: Hall's theorem. König's theorem.
- Week 10: Matchings in general graphs: Tutte's Theorem. Tutte-Berge's formula.
- Week 11: Planar Graphs. Jordan curve theorem. Euler's Formula. Triangulations.
- Week 12: Polytope. Platonic Solids.
- Week 13: Vertex colouring. k -critical. Simple bounds on the chromatic number.
- Week 14: Greedy colouring. k -degenerate graph. Brooks' theorem.
- Week 15: Colouring planar graphs. Heawood's theorem. The 4-colour theorem. The art gallery theorem. Gallai-Roy's theorem.