COURSE DESCRIPTION
GRAPH THEORY AND COMBINATORICS
MA 637-OV
SUMMER 2024

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ALABAMA AT BIRMINGHAM

Course Instructor: Professor Nikita Selinger
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Office Hours: By appointment

Meeting times: TuTh, 10:20 – 12:20
Meeting location: UH 4004
Textbook: *Graph Theory by Adrian Bondy and M. Ram Murty.*

Course Description

Graph Theory is a relatively new area of mathematics, first studied by the super famous mathematician Leonhard Euler in 1735. Since then it has blossomed in to a powerful tool used in nearly every branch of science and is currently an active area of mathematics research. Knowledge of Graph Theory is in high demand by computer science employers. In fact, technical interviews are often centered around concepts of Graph Theory alone! They do this for good reason; Graph Theory provides a framework to model a large set of problems in CS. Many graph problems are intractable and provide a useful tool for studying computational complexity. It also has natural connections to combinatorics, topology, and algebra. In mathematics, the elegance of its perspective on some problems is moving.

Topics covered include specialized eulerian and hamiltonian graphs; matrices of graphs and information about graphs obtained from matrices; topological graph theory, including planarity theorems of Kuratowski, Whitney and MacLane and also embeddings of graphs in surfaces of higher genus and in nonorientable surfaces; Menger's theorem and network flows; the graph reconstruction problem; counting techniques, including the Pigeonhole Principle and the use of generating functions; Dilworth's theorem; Sperner's lemma; matching theory and the classical theorem of Philip Hall, the Four-Colour problem.

Course policies:

- Please make sure that you are able to receive e-mail through your Blazer-ID account. Official course announcements may be sent to that address.
- If your are contacted by the Early Alert Program, you should consider taking advantage of the services it offers. Various services to assist you are also listed in the *Student Resources* section of the *Blazernet* web site.
- If you wish to request a disability accommodation please contact DSS at 934-4205 or at *dss@uab.edu*.
- If a test is missed due to a serious verifiable circumstance or official university business, the test grade will be replaced with the properly rescaled final exam score. If you miss the final exam you will receive a zero score for this exam. In all cases you **must** contact your instructor of such circumstances **before** the exam takes place.

Learning outcomes:

By the end of the course, students will:

- understand graphs and applications thereof,
- be able to prove well known results about graphs,
- be able to solve a varietry of problems in graph theory and combinatorics,
- be aware of various counting techniques,
- know how to use generating functions in computations and proofs.