

Fall 2015

Math 475 – Combinatorial Mathematics (3)

Finite configurations. Topics may include counting methods, generating functions, graph theory, map coloring, block design, network flows, analysis of discrete algorithms.

Pre: 311 or consent

1. Enumerative Combinatorics

Permutations and combinations; rules of sum and product; distributions of distinct and nondistinct objects; inclusion-exclusion principle; the pigeonhole principle; Stirling's formula.

2. Generating Functions and Recurrence Relations

Ordinary and exponential generating functions; elementary relations; recurrence relations.

As time permits, a selection of topics from the following list:

3. Fundamental Concepts in Theory of Graphs

Connectedness; Euler path; Hamiltonian path.

4. Trees, Circuits, and Cut-sets

Spanning trees; cut-sets; linear vector spaces; vector spaces associated with a graph; bases of subspaces; matrix representations.

5. Planar and Dual Graphs

Euler's formula; Kuratowski's theorem; dual graphs.

6. Domination, Independence, and Chromatic Numbers

Dominating and independent sets; chromatic numbers; the Four-color problem.

7. Transport Networks

Cuts; max-flow min-cut theorem; extensions.

8. Matching Theory

Complete and maximal matchings; alternative approach.

Possible textbooks: *A Walk Through Combinatorics*, by Miklos Bona. *Combinatorics, A Guided Tour*, by David R. Mazur. *A Course in Combinatorics*, by J.H.Van Lint and R.M.Wilson

Course Objectives. Upon successful completion, the student will have a foundation in the basic topics of the theory of Combinatorics listed above in the syllabus. Emphasis on rigor will provide students the understanding needed for graduate work, and in the study of the logical foundations of mathematics.

Program Objectives. Math 475 is a senior level course in Combinatorics, an important subject with many applications in Mathematics, Operations Research and Computer Science. This course promotes our goal that our students learn, understand, and be able to apply several mathematical topics at the junior and senior level, and that our students acquire the ability and skills to apply mathematics to other fields.