

OFFICIAL SYLLABUS
MATH 423 – Combinatorics and Graph Theory
Adopted - Spring 2004 (Committee: Drs. J. Parish, E. Sewell)

Course Description. Methods of solving problems which are discrete in nature. Counting, combinatorial reasoning and modeling, generating functions, recurrence relations. Graphs: definitions, examples, basic properties, applications, algorithms. Prerequisites: 223, some knowledge of programming is recommended.

Textbook. Applied Combinatorics, Fifth Edition, by Alan Tucker

Course Outline and Topics

Chapter 1: Elements of Graph Theory

- 1.1 Graph Models
- 1.2 Isomorphism
- 1.3 Edge Counting
- 1.4 Planar Graphs

Chapter 2: Covering Circuits and Graph Coloring

- 2.1 Euler Cycles
- 2.2 Hamilton Cycles
- 2.3 Graph Coloring
- 2.4 Coloring Theorems

Chapter 3: Trees and Searching

- 3.1 Properties of Trees
- 3.2 Search Trees and Spanning Trees
- 3.3 The Traveling Salesperson Problem
- 3.4 Tree Analysis of Sorting Algorithms (Optional)

Chapter 4: Network Algorithms

- 4.1 Shortest Paths
- 4.2 Minimal Spanning Trees
- 4.3 Network Flows
- 4.4 Algorithmic Matching (Optional)

Chapter 5: General Counting Methods for Arrangements and Selections

- 5.1 Two Basic Counting Principles
- 5.2 Simple Arrangements and Selections
- 5.3 Arrangements and Selections with Repetitions
- 5.4 Distributions
- 5.5 Binomial Identities

Chapter 6: Generating Functions

- 6.1 Generating Function Models
- 6.2 Calculating Coefficients of Generating Functions
- 6.3 Partitions (Optional)

Chapter 7: Recurrence Relations

- 7.1 Recurrence Relation Models
- 7.2 Divide-and-Conquer Relations
- 7.3 Solution of Linear Recurrence Relations (Optional)
- 7.4 Solution of Inhomogeneous Recurrence Relations (Optional)
- 7.5 Solutions with Generating Functions (Optional)

Any instructor should cover all of the material specified; any additional sections are optional.