# ALGORITHMIC COMBINATORICS

# MATH/CSCI 8060

**Course Description:**

This course includes classical combinatorial analysis graph theory, trees, network flow, matching theory, external problems, and block designs. **3 credits**

This course is about classical combinatorial analysis, search theory, network flow, matching theory, extremal problems, block designs. We study specific algorithms for a variety of combinatorial problems, as well as general design and analysis techniques. It is divided on two parts: Chapters 1-10 and 12-17 in the text.

**Prerequisites:**

MATH/CSCI 3100/8105 or instructor's permission.

**Overview of Content and Purpose of the Course:**

Combinatorics is a subject of increasing importance because of its links with computer science, statistics, and algebra. This course stresses common techniques, such as generating functions and recursive construction, that underlie the great variety of subject matter, in addition to the fact that a constructive or algorithmic proof is more valuable than an existence proof. On the lectures, mostly techniques will be emphasized as well as topics and many algorithms will be described in simple terms. Specific algorithms will be studied for a variety of combinatorial problems, as well as general design and analysis techniques. The course should provide essential background for students in all parts of discrete mathematics.

**Anticipated Audience/Demand:**

This course is for graduate students in Mathematics and Computer Science.

**Major Topics:**

**1)** Subsets, Partitions, Permutations

**2)** Recurrence Relations and Generating Functions

**3)** Latin Squares and System of Distinct Representatives

**4)** Extremal Set Theory

**5)** Ramsey's Theorem

**6)** Search Theory

**7)** Network Algorithms

**8)** Designs

**Methods:**

This course will be presented in a lecture/discussion format. Problems will be discussed during lectures, as well discussion of current research problems.

**Student Role:**

Students must attend class, participate in discussions, and complete all course requirements.

**Textbook:**

Cameron, Peter J. *Combinatorics: Topics, Techniques, Algorithms*. Cambridge: Cambridge University Press, 1995.

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