

**MATHEMATICS 3340**  
**INTRODUCTORY COMBINATORICS**

Combinatorics (also called as combinatorial analysis or combinatorial theory) is a branch of mathematics in which the central problem may be considered that of arranging objects according to specified rules and determining the number of ways that this can be done. For relatively simple rules, the main emphasis is on the enumeration of the number of ways in which the arrangement may be made. For more complicated rules, the objective is to determine the existence of arrangements and methods for constructing the arrangements.

As a field of study, combinatorics can be both challenging and fun. On the one hand, combinatorial mathematics has applications to other areas of mathematics and computer science. On the other, some applications involving games and puzzles are meant to be recreational in nature.

Problem solving is important in all areas of mathematics but especially in combinatorics. Particularly useful are techniques such as induction, iteration, and recursion, in which solutions to smaller problems are used to obtain a solution for a related larger problem. These techniques are the basis for many algorithms in computer science.

In an introductory course such as this, there is an emphasis on so-called counting problems, determining the number of ways that something can be done. In this context, counting is a useful skill. It can, for example, be used to estimate the number of steps required for a particular algorithm in order to determine the feasibility of solving a problem on a computer or to determine which of several solutions is best.

Many problems in combinatorics are expressed in everyday English so that it is necessary to formulate the problem in terms of an appropriate mathematical model in order to apply basic techniques. Hence, an important aspect of the course is that of elementary mathematical modelling, which is the basis of all applied mathematics.

**Text.** One text often used is *Applied Combinatorics* by Alan Tucker.

**Marks.** Normally, students are evaluated on the basis of a final examination worth 50% of the final grade, a midterm exam worth 30% and weekly assignments worth 20%.

**Calendar description.** **3340 Introductory Combinatorics** includes topics: distributions, the binomial and multinomial theorems, Stirling numbers, recurrence relations, generating functions and the inclusion-exclusion principle. Emphasis will be on applications.  
Prerequisite: Mathematics 2320.

**Offered.** Winter