

Introduction to Probability

Madhuka and Rajinda

2025-03-31

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Preface

Introduction to Probability is a freely available textbook for MATH350 students.

- This version contains variety of examples to learn the probability concepts in your own phase.
- The book can be downloaded as a pdf.

Chapter 1

Fundamentals of Probability and Its Axioms

1.1 Combinations and Permutations

Counting plays a very important role in probability. In probability, we often deal with sets, and counting methods such as combinations and permutations help us find the number of elements in a set. Specifically, in probability, we deal with a set called the **sample space** which is the set of all possible outcomes of some random experiment and **events**, which are subsets of the sample space. Typically, the sample space is denoted by S or Ω . Consider the following example:

Example 1.1. Suppose a fair coin is flipped twice. What is the probability of flipping at least one head?

Solution: The sample space of this experiment can be expressed as $S = \{HH, HT, TH, TT\}$. Now, consider the event:

$$A = \{\text{At least one outcome is a head}\}$$

Notice that $A \subset S$ (A is a subset of S). Since $A = \{HH, HT, TH\}$, we can find the probability as follows:

$$P(A) = \frac{\text{\#elements in } A}{\text{\#elements in } S} = \frac{3}{4}.$$

Chapter 2

Basic Probability