

Probability Through Counting

From equally likely outcomes to conditional probability and a real-world diagnostic-test model.

Part 1: Counting equally likely outcomes



A coin

A fair coin is tossed three times. What is the probability of getting exactly two heads?



One die

A fair six-sided die is rolled once. What is the probability of obtaining a number divisible by 2 or by 3?



Two dice

Two fair six-sided dice are rolled together. What is the probability that their sum is 7?



Cards from one suit

Five cards are selected at random from a standard 52-card deck. What is the probability that all five cards are from the same suit?



At least one ace

Five cards are selected at random from a standard 52-card deck. What is the probability that the hand contains at least one ace?



A lottery

A lottery asks players to select 6 numbers from 45. Six winning numbers are then drawn. What is the probability of matching exactly 3 numbers?



Pastries with repetition

A bakery sells four types of pastry. Every unordered way to buy eight pastries is treated as equally likely. What is the probability that the purchase contains at least one pastry of every type?

Part 2: Without replacement



Two balls

A box contains 5 red and 7 blue balls. Two balls are drawn at random without replacement. What is the probability that both are red?



Two cards

Two cards are drawn from a standard 52-card deck without replacement. What is the probability that both are aces?



Three balls in order

A box contains 4 red, 3 blue, and 5 green balls. Three balls are drawn without replacement. What is the probability of drawing red first, blue second, and green third?

Part 3: A real-world model



A rapid diagnostic test

Assume a rapid test has 55% sensitivity and 99.5% specificity. In a group of 10,000 people, 200 have the condition. A randomly selected person tests positive. Estimate the probability that the person truly has the condition. Use a frequency table rather than a memorized formula.
