Section 7.4

Modeling Probability: Equally Likely Outcomes

In an experiment in which all outcomes are equally likely, the probability of an event E is given by

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{n(E)}{n(S)}.$$

Problem 1. Suzy is given a bag containing 4 red marbles, 3 green ones, 2 white ones, and 1 purple one. She grabs five of them. Find the probabilities of the following events, expressing each as a fraction in lowest terms.

a) She has all the red ones.

b) She has at least one white one.

c) She has two red ones and one of each of the other colors.

d) She has at most one green one.

Solutions here.

Problem 2. A test has three parts. Part A consists of eight true false questions, Part B consists of five multiple choice questions with five choices each, and Part C requires you to match five questions with five different answers one-to-one. Assuming that you make random guesses in filling out your answer sheet, what is the probability that you will earn 100% on the test?

Solution here.

Problem 3. Tyler and Gebriella are among seven contestants from which four semifinalists are to be selected at random. Find the probability that neither Tyler nor Gebriella is selected.

Solution here.

Problem 4. You are asked to calculate the probability of being dealt various poker hands. (Recall that a poker player is dealt 5 cards at random from a standard deck of 52.)

a) One pair: 2 cards with the same denomination and 3 cards with other denominations.

b) Two pair: 2 cards with one denomination, 2 with another, and 1 with a third.

c) Flush: Five cards of the same suit, but not a straight flush or a royal flush.

For the solutions to these problems, see this website. Note that this site uses different notation for combinations: $C(n,r)$ is written as $\binom{n}{r}$.

Problem 5. In order to play the Mega Millions Lottery, we need to choose a ticket with five numbers from the set $\{1, 2, \dots, 56\}$, and one number from the set $\{1, 2, \dots, 46\}$. The order of the first five numbers does not matter.

a) How many different tickets can we buy?

b) How many tickets match all six winning numbers?

c) We will win the Jackpot if we match all six winning numbers. Suppose we buy one ticket. What is the probability that we will win the Jackpot?

d) We will win \$10,000 if we match four of the five winning numbers from $\{1, 2, \dots, 56\}$, and the one winning number from $\{1, 2, \dots, 46\}$. How many different tickets will win \$10,000?

e) What is the probability that we will win \$10,000 with one ticket?

Solutions here.