Probability Worksheet

Day 1

Introduction

These initial problems will help get us oriented in a context that is more familiar. In each, we will be referring to a standard "die" (singular of dice) that has 6 faces, each with an equal chance of being rolled

Part A What is the chance of getting a 1 when rolling a die once?

Part B When rolling a die once, what is the chance of rolling a 1 *or* a 2?

Part C When rolling a die once, what is the chance of rolling a 1 *and* a 2?

Part D What is the chance of rolling a 1,2,3,4,5, or 6?

Part E What is the chance of *not* rolling a 2?

Problem 1 (Addition Rule)

Question 1 Here, we concern ourselves with 10,000 individuals who either (1) rent their home (3,858), (2) have a mortgage on their home (4,789), or (3) own it outright (1,353).

- What proportion of individuals have either a mortgage or own it outright?
- If we select one person out of this 10,000 at random, what is the probability that this person either owns their own or has a mortgage?

Question 2 Consider rolling a dice where we define three different events:

$$A = \{1, 2\}, \quad B = \{4, 6\}, \quad D = \{2, 3\}$$

- What is the probability of event A?
- Are events B and D disjoint? Confirm the addition rule by finding the probability that either B or D occurs.

Problem 2 (General Addition Rule)

Question 1 If events A and B are disjoint, explain why this implies that $P(A \text{ and } B) = 0$. Verify that the General Addition Rule simplifies to the Addition Rule when A and B are disjoint.

Question 2 In a sample of 10,000 homes, 1495 homes were painted blue, 4789 had a garage, and 950 homes had both of these properties. Create a Venn diagram illustrating this problem.

Problem 3 Using the information from Question 2, what is the probability that a home selected at random had a garage but was not painted blue?

Problem 3 (Compliments)

Question 1 For a single dice roll, let $D = \{2, 3\}$. What is D^C? Find $P(D)$ and $P(D^C)$

Below is a table showing the probability of finding a sum after rolling two dice

Dice Sum	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

Question 2 Let A represent the event in which we roll two dice and their total is less than 12. What does A^C represent?

Question 3 Find the following probabilities from rolling two dice:

- The sum of the dice is *not* 6
- The sum is *at least* 4
- The sum is not more than 10