Class Exercise 4

1. **Multiple Choice**

   For each question below, select **all** the statements that are **correct**. Each question has **at least one correct answer, but not necessarily all options are correct**. You will receive **full credit** if and only if you select all correct answers and **no incorrect answers**. Selecting an incorrect option or missing a correct option may result in **partial credit or no credit**.

   A. Which of the following statements about **relative frequency, probability, and the Law of Large Numbers** are true?

      a. The relative frequency of an event is the ratio of its observed count to the total number of trials.
      b. Theoretical probability describes the expected proportion of times an event occurs in the long run.
      c. As the number of trials increases, the relative frequency tends to approach the theoretical probability.
      d. The Law of Large Numbers guarantees that short sequences will exactly match theoretical probabilities.
      e. Differences between observed and theoretical probabilities are due to random variation and tend to shrink as the sample size grows.

   B. Which of the following statements about **theoretical and empirical probabilities** are true?

      a. The theoretical probability of each outcome on a fair four-section spinner is $\frac{1}{4}$.
      b. If 1 occurs 48 times, 2 occurs 49 times, 3 occurs 50 times, and 4 occurs 53 times out of 200 spins, the results are approximately balanced.
      c. A small deviation from the theoretical count is evidence that the spinner is biased.
      d. Relative frequencies may differ slightly from theoretical probabilities due to randomness.
      e. The experiment supports that the spinner is approximately fair.

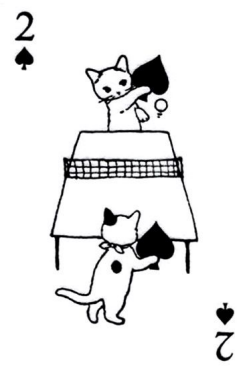
2. **The Longest Poker Game**

The longest poker game lasted over 8 years. Taking place at the Bird Cage Theatre in Arizona in 1881, this game was a marathon of strategy and endurance. Also an exercise in patience, dedication and perhaps boredom.

Cards: A standard poker deck has 52 distinct cards:

$$\text{rank} = \{A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K\}$$

$$\text{suit} = \{\clubsuit, \heartsuit, \spadesuit, \diamondsuit\}$$



For each of the following questions, assume a standard **5-card poker hand** is dealt at random.

a. What is the probability that all cards are the same *color* (all red or all black)?

b. What is the probability of being dealt a *full house* (three of one rank and two of another)?

c. What is the probability of being dealt a *straight flush* (five consecutive cards of the same suit)?

d. What is the probability of being dealt *exactly one Ace*?

e. What is the probability of being dealt *at least one Ace*?