Basic Probability Rules **Workshop**

An **event** is a subset of the possible outcomes in a probability model. We use capital letters like A or E to represent events, and $P(E)$ is short-hand for the phrase *"the probability that event E happens"*. Two events A and B are **disjoint** if the cannot both happen at the same time. Two events A and B are **independent** if the probability of A happening doesn't depend at all on whether B happens or not.

Complementary Events $P(A \text{ does not happen}) = 1 - P(A)$.

Addition Rule $P(A \text{ or } B) = P(A) + P(B)$ if A and B are **disjoint** events.

Multiplication Rule $P(A \text{ and } B) = P(A)P(B)$ if A and B are **independent** events.

1. For each of the following pairs of events, decide whether they are independent or not.
   (a) It rains today *and* the baseball game today is canceled.

   (b) You win the lottery *and* it rains next week.

   (c) A random person was a cheerleader in high school *and* they are female.

2. Bob is taking a multiple choice test. Each question has five options. For the last two questions, Bob has no clue which answer is correct, so he guesses.
   (a) What is the probability that Bob gets both questions wrong?

   (b) What is the probability that Bob gets both questions right?

   (c) What is the probability that Bob gets one question wrong and one question right? Hint: He might get the first one right and the second one wrong. Or it might turn out the other way around.

3. A Pew Research survey asked 2,373 randomly sampled registered voters their political affiliation (Republican, Democrat, or independent) and whether or not they identify as swing voters. 35% of respondents identified as independent and 23% identified as swing voters. There was overlap in those two categories: 11% of voters identified as both independent and swing voters.

   (a) How many voters identify themselves as independent, but not swing?

   (b) What percent of voters are neither independent nor swing voters?

   (c) Is the event that someone is a swing voter independent of the event that someone is a political independent? (Hint: If they were independent, then the multiplication rule would work. Does it?)

4. Only 7.2% of Americans have type O-negative blood (they are the universal donors). If two donors show up at the hospital, what is the probability that neither are universal donors?

5. In a group of 10 people, what is the probability that at least one is type O-negative? Hint: First figure out the probability that no one in the group is O-negative.