HW06 - Probability Basics

Stat 131A, Spring 2019

General Instructions

- Write your narrative and code in an `Rmd` (R markdown) file.
- Name this file as `hw06-first-last.Rmd`, where `first` and `last` are your first and last names (e.g. `hw06-gaston-sanchez.Rmd`).
- Please do not use code chunk options such as: `echo = FALSE`, `eval = FALSE`, `results = 'hide'`. All chunks must be visible and evaluated.
- Submit your Rmd and html files to bCourses.

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1) Suppose that 25% of a forest consists of trees of species A, 40% of species B, and 35% of species C.

a. What is the probability that a tree selected at random will be of species A?

b. What is the probability that the tree selected will not be of species A?

c. If it is known that the tree is not of species A, what is the probability that it will be of species B?

2) At a certain university in the United States, 62% of the students are at least bilingual speaking English and at least one other language. Of these students, 80% speak Spanish and, of the 80% who speak Spanish, 10% also speak French. Determine the probability that a randomly selected student at this university:

a. Does not speak Spanish.

b. Speaks Spanish and French.

3) A poker hand is dealt. Find the chance that the first four cards are aces and the fifth is a king. Show your work.

4) One ticket will be drawn at random from the box below. Are color and number independent? Explain.

5) A coin is tossed six times. Two possible sequences of results are:

i. `H T T H T H`

ii. `H H H H H H`

(The coin must land `H` or `T` in the order given; `H` = heads, `T` = tails.) Which of the following is correct? Explain?

a. Sequence (i) is more likely.

b. Sequence (ii) is more likely.

c. Both sequencies are equally likely.

6) A die is rolled four times. What is the chance that:

a. all the rolls show 3 or more spots?

b. none of the rolls show 3 or more spots?

c. not all the rolls show 3 or more spots?

7) A die is rolled 10 times. Find the chance of:

a. getting 10 sixes.

b. not getting 10 sixes.

c. all the rolls showing 5 spots or less.

8) Which of the two options is better, or are they the same? Explain.

i. You toss a coin 100 times. On each toss, if the coin lands heads, you win \$1. If it lands tails, you lose \$1.

ii. You draw 100 times at random with replacement from a box containing two tickets: `(1, 0)`. On each draw, you are paid (in dollars) the amount on the ticket.

9) Suppose the probability of being diagnosed with a rare disease is 10 per 100,000 individuals who are at risk for the disease.

a. What is the probability no cases will be diagnosed in a community of 20,000 people? Assume each diagnosis is independent of any other diagnosis.

b. What is the probability of at least one diagnosed case among the 20,000 individuals? Assume each diagnosis is independent of any other diagnosis.

10) Suppose that A and B are independent events with $P(A) = 0.7$, and $P(B^c) = 0.4$. Find the following probabilities:

a. $P(A^c) =$

b. $P(B) =$

c. $P(B \text{ and } A) =$

d. $P(A \text{ or } B) =$

e. $P(A^c \text{ and } B) =$

f. $P(B|A) =$

11) One ticket will be drawn at random from each of the two boxes shown below:

- A. `[1, 2, 3]`
- B. `[1, 2, 3, 4]`

Find the chance that:

a. The number drawn from A is larger than the one from B.

b. The number drawn from A equals the one from B.

c. The number drawn from A is smaller than the one from B.

12) The chance of A is 1/3; the chance of B is 1/10. True or False, and explain.

a. If A and B are independent, they must also be mutually exclusive.

b. If A and B are mutually exclusive, they cannot be independent.