DSC 40A - Group Work Session 5

due November 4, 2021 at 11:59pm

Write your solutions to the following problems by either typing them up or handwriting them on another piece of paper. You must work in a group of 2 to 4 students for at least 50 minutes to get credit for this assignment. It's best to join a discussion section if possible.

One person from each group should submit your solutions to Gradescope by 11:59pm on Thursday. Make sure to **tag all group members** so everyone gets credit. This worksheet won't be graded on correctness, but rather on good-faith effort. Even if you don't solve any of the problems, you should include some explanation of what you thought about and discussed, so that you can get credit for spending time on the assignment.

1 Probability

Note that we will start covering the basics of probability in Tuesday's lecture, but will cover them in more depth in Thursday's lecture. Feel free to wait until after Thursday's lecture to complete these problems, or look at some of the many probability resources now linked on the resources tab of the course website. It may also help to look back at the probability covered in DSC 10. Remember that groupworks are graded on best effort, not correctness.

Most probability questions can be solved by applying one of the basic probability rules in the right way. Sometimes, some cleverness is needed to define the right sample space or the right events. There are often many ways to solve the same problem, some easier than others. It's really useful to learn multiple ways of doing the same problem, which will help you develop your problem-solving skills.

Here are the basic probability rules you'll need to use to solve the questions that follow.

Addition Rule:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Multiplication Rule:

$$P(A \cap B) = P(A) \cdot P(B|A)$$

Complement Rule:

$$P(\overline{A}) = 1 - P(A)$$

Conditional Probability:

$$P(E|F) = \frac{P(E \cap F)}{P(F)}$$

Problem 1.

A bitstring is a sequence of 0s and 1s. For example, 0110100 is a bitstring of length 7.

Suppose that we generate a bitstring of length 4 such that each digit is equally likely to be a 0 or 1.

a) What is the probability that the bitstring is 1111?

b) What's the probability that the bitstring contains at least one 0 and one 1?

c) What is the probability that a bitstring has more 0s than 1s?

d) What is the probability that a bitstring has more 0s than 1s, if we know that the first bit is a 0?

e) Suppose now that you generate two bitstrings and look at one of them. You see that this bitstring has more 0s than 1s. What is the probability that in total, for both strings together, there are more 0s than 1s?

Problem 2.

Suppose you have 6 pairs of sock in your sock drawer and every pair has a unique color. It is still dark out in the morning when you get dressed, so you just pull socks out of the drawer at random, one at a time, until you have removed two matching socks. What is the probability that you pull out exactly 5 socks from your sock drawer in the morning?

Problem 3.

Assume that every time you hit shuffle on Spotify, the chance that the song "Industry Baby" by Lil Nas X and Jack Harlow plays is 2%. How many songs must you listen to so that the probability of hearing Industry Baby exceeds 90%?

Problem 4. (Optional – this is good practice, but we won't require you to submit it)

Suppose we scramble the 26 letters of the alphabet in a random order so that each rearrangment is equally likely. What is the probability that the letters ABC wind up next to each other in that order?