

CS 6316

Homework 0: Probability Warmup

Due date: August 30, 2017

OBJECTIVE:

- Reviewing background on general math/probability including Bayes Theorem

INTRODUCTION:

These 10 warmup exercises test your knowledge on general math/probability. You are also tested on topics related to Bayes Theorem which was introduced in class. Carrying out this assignment should serve as a review.

EXERCISES:

Question 1: (*General probability*)

Circle one or more letters (a) to (j) below if the number or expression *cannot* be the result (value) of a probability experiment:

- (a) 0.7
- (b) 1.101
- (c) $(3*5) / (2*8)$
- (d) 0
- (e) 1
- (f) -0.3007
- (g) $9/10$
- (h) $10/9$
- (i) $(2*8) / (3*5)$
- (j) 20%

Question 2: (*General probability*)

What is the probability that rolling two dice results in an outcome (two numbers) that add up to 7?

Question 3: (*Basic concepts*)

A bag is filled with 1 red ball, 2 blue balls, and 3 green balls. Take three balls out of the bag.

- (a) Name the sample space.
- (b) Give an example of a simple event and calculate its possibility.

Question 4: (*Conditional probability*)

Two dice are rolled.

A = 'sum of two dice equal to 8'

B = 'sum of two dice is larger than 6'

C = 'at least one of the dice shows number larger than 3'

- (a) What is $P(A|C)$?
- (b) What is $P(B|C)$?
- (c) Are A and C independent? Why?

Question 5: (*Total probability*)

A toy shop sells four kinds of stuffed animals (bear-B, lion-L, unicorn-U & dog-D), each available in 3 colors.

- (a) Write an expression for total probability that a randomly selected stuffed animal is white (one of the three colors), $P(W)$, using \cap operator.

Hint: sum of the probabilities each kind of stuffed animal is white.

- (b) Modify the expression from (a) above to use conditional probability.

Hint: Use the rule $P(A|B) = \frac{P(A \cap B)}{P(B)}$, where $P(B) > 0$

Question 6: (*General probability*)

A night watchman is supposed to guard a warehouse at night, 7 nights a week, from 9 PM to 5 AM. However, he is not a very honest person and 2 days each week he does not go for duty and stays home. A supervisor visits once a week at night to check if the watchman is on duty.

What is the probability that the supervisor goes to the warehouse and finds that the watchman was not on duty?

Question 7: (*Normal curve*)

A person having Diabetes, tests his blood sugar 3 times each day. His test results of the last 3 months are a normal distribution with mean 120 and Standard Deviation 30. He is planning to test his blood sugar now. What is the probability that this reading will be above 150 or below 90?

Question 8: (Bayes Theorem)

John, Adam, and Elizabeth are baking cookies to raise money. John made 100 cookies, Adam made 60 cookies, and Elizabeth made 140 cookies. Only cookies with good conditions can be sold, so each cookie is checked for shape.

(a) The number of defective cookies each person made are as follows:

John: 20 cookies, Adam: 6 cookies, and Elizabeth: 21 cookies.

If a randomly selected cookie is defective, what is the probability it was made by John?

(b) Instead of the actual number of defective cookies (D), the defective rates for each person is given as the following:

John: $P(D|John) = 20\%$

Adam: $P(D|Adam) = 15\%$

Elizabeth: $P(D|Elizabeth) = 10\%$

If a randomly selected cookie is defective, what is the probability it was made by John?

Question 9: (Conditional probability)

In a class, 45% of the students are studying Artificial Intelligence (AI) and Machine Learning (ML), 55% of the students are studying AI. What is the probability of a student studying ML given that she/he is already studying AI?

Question 10: (General probability)

An office desk drawer has 3 green, 2 white and 5 black pens. If a pen is picked at random from the drawer and *replaced back* into the drawer and the process is repeated 4 times, what is the probability of drawing 2 black pens and 2 white pens?

GRADING:

- This assignment is *not graded*, however it will count towards general participation in the course. You are required to submit the answers to these exercises.

SUBMITTING:

- Submit on Collab
- Submit 1 **PDF** document as your homework
- You must work individually on this homework
- Your submitted homework must be typed
- At the top of your document be sure to include your name and computing ID
- The submission deadline is **11:30pm** on the date the assignment is due, mentioned above