

Math 113 Stretch 5

Spring 2023, Section 4, Mr. Joshua Siktar

March 31, 2023

1 Conceptual Probability Questions (6 points)

a. Which one of the following best explains the Law of Large Numbers?

- If you are conducting trials over and over again, as you conduct more trials, the proportion of an event gets closer and closer to the theoretical probability.

- If you are conducting many trials, the larger the number of trials you have, the larger the probability becomes.

- The more trials you conduct in any random probability experiment, the more likely you are to have a probability equal to one half.

- No matter what you are doing, if you do it enough times, you will eventually see a pattern in the randomness, and it will always approach pi.

b. Which one of the following best describes the Gambler's fallacy?

- The gambler's fallacy is when someone believes that an outcome's likelihood has been influenced by the outcomes of previous trials, even if the events were independent.

- The gambler's fallacy is when someone believes that an outcome's likelihood has been influenced by the outcomes of previous trials, even if the events were dependent.

- The gambler's fallacy is when someone believes that an outcome's likelihood has not been influenced by the outcomes of previous trials, even if the events were independent.

- The gambler's fallacy is when someone believes that an outcome's likelihood has not been influenced by the outcomes of previous trials, even if the events were dependent.

c. Which of the following are example(s) of the gambler's fallacy? There may be one correct answer, or there may be more than one.

This roulette wheel has been giving us a streak of black, so I bet red will be more likely next.

If you flip a fair coin, there is a .5 probability that the coin will land on heads.

If you flip two coins, there is a one third chance you will get two heads, because there are three possible outcomes: 2 heads, 2 tails, and 1 of each.

The larger the bet I place on this, the more likely I am to win.

2 Dartboards [7 points]

You have two square-shaped dartboards, where the squares both have side length 10 cm. Each dartboard has a red circle inside the square. The left dartboard has a circle of radius 2 cm on it. The right dartboard has a circle of radius 3 cm on it.

- a. If you throw darts at each dartboard, what is your guess for which red circle will be easier to hit? Explain your reasoning. Assume any dart you throw hits the board you wanted it to.
- b. Actually calculate the probabilities of hitting the red circles.
- c. **Bonus [up to 3 points]:** Now you have a third square-shaped dartboard, where the square has side length 10 cm. This dartboard also has a red circle inside the square, but the diameter is an unknown number, x . You know that the probability of throwing a dart inside the circle is .5 (assuming the dart actually hits the board somewhere). Find the value of the diameter x .

3 Voting Methods [9 points]

a. Suppose three candidates are running in an election, and each person voting lists their first choice, second choice, and third choice. In the plurality method, which of these is the only one that is taken into account?

- A. First choices
- B. Second choices
- C. Third choices
- D. They are all taken into account

b. Do you think plurality with elimination is more fair than plurality without elimination? Explain why or why not.

c. Go back to the car, boat, train table on Slide 14 of the DECISION Day 10 slides. The first row of the table has the number of people who voted for each preference order. Using some trial and error, change the numbers in the top row in such a way that the car wins by Borda Count instead of train. **Please hand-draw the full preference table you use. Answers will vary.**