

1. For each of the following situations, determine whether or not the given random variable has a binomial distribution. Justify your answer.
 - a. In a bookstore's "Top Reads" shelf, four out of the 20 books are by the same author. Suppose you select 3 books from the shelf at random. Let X be the number of selected books that are by this author.
 - b. The internet at a certain café is not working 4% of the time. Suppose you and your four friends each go to this café once at a random time over the span of a month, independently of one another. Let Y be the number of people in your friend group who go to the café and can access the internet.
2. In the game of "Macke" you roll six dice and earn 100 points for any die that lands on a 1 and 50 points for any die that lands on a 5. No points are earned for any other number. Let X be the number of dice that earn points from the initial roll of six dice.
 - a. Explain why X is binomial. Identify the number of trials (n) and the probability of success (p).
 - b. Calculate the probability that exactly four out of the six dice earn you points on the initial roll. Show your work.

3. The probability that it rains in London, England, on a randomly selected day in April is 0.30. Kira will lead walking tours in London for five randomly selected days in April. She says that the probability of it raining on exactly one of her five days giving tours is the same probability of it raining on exactly four of her five days giving tours since there are 5 ways to choose 1 out of 5 days and also 5 ways to choose 4 out of 5 days. (${}_5C_1 = {}_5C_4 = 5$) .

Do you agree with Kira's reasoning? Explain.

4. A company sends a weekly digital newsletter to people who are on their email list. This weekly email has a 38% open rate, meaning that 38% of people on the email list click on the email in their inbox to read it. Suppose that a random sample of 10 people from the very large email list is selected.
- a. Consider the probability that exactly 6 people in the sample open the email. Define the random variable of interest and state how the random variable is distributed.
- b. Calculate the probability that exactly 6 people in the sample open the email. Show your work.

5. Joseph Girard III of Clemson University currently holds the record for the highest free-throw percentage in men's college basketball, as reported by the association governing college athletics, the NCAA. His free-throw percentage is 95%, which represents the percent of free-throws he successfully makes. Assume Girard maintains this success rate and that his free throws are independent. Consider his next 94 attempted free throws. Let X be the number of free throws Girard makes in the 94 free throw attempts.
- How many of the 94 free throws would you expect Girard to make?
 - Calculate $P(X = 89)$ and interpret the result.
 - Calculate the probability that Girard makes at least 92 of his free throws.
6. Each of the twelve classroom teachers at an elementary school, two from each grade level kindergarten through fifth grade, randomly selects one student from their class and asks them about their bedtime. Let X be the number of students who have a bedtime later than 8 PM. Which of the following provides the best reason why X is not a binomial random variable?
- There are more than two possible outcomes since the number of possible bedtimes is infinite.
 - The teachers don't choose students independently of one another.
 - The number of students being chosen is not fixed.
 - The probability of choosing a student with a bedtime later than 8pm likely differs by grade level.

7. When people apply for their driver's license at the Department of Motor Vehicles (DMV), their eye color is recorded. In the U.S., the proportion of people who have blue eyes is 0.27. What is the probability that at least one of five people who apply for a driver's license on a particular day has blue eyes? Assume that the five people are not related in any way and go to the DMV independently of one another.
- A) 0.7927
 - B) 0.5907
 - C) 0.4093
 - D) 0.3834