Practice Assignment: Discrete Probability Distributions

Questions 1–3: In the same survey of college students that we explored during the in-class activity,[1] participants were asked, "Out of the last 7 days, how many days did you have an extremely hard time falling asleep?"

The table below displays the responses to this question, as well as the probability associated with each response.

D, **Number of days**	$P(D)$
0	0.336
1	0.231
2	0.143
3	0.085
4	0.051
5	0.053
6	0.028
7	0.074

1) Which of the statements below is an accurate interpretation of the mathematical statement, "$P(D = 5) = 0.053$?"

   a) The percentage of surveyed college students who had a hard time falling asleep on 5 out of the last 7 days is 0.053.

   b) The percentage of surveyed college students who had a hard time falling asleep on 5 of the last 7 days is 53%.

   c) The probability of a surveyed college student having a hard time falling asleep on 5 out of the last 7 days is 0.053.

   d) The probability of a surveyed college student having a hard time falling asleep on 5 or more days out of the last 7 days is 0.053.

[1] American College Health Association-National College Health Assessment. (2020). *Undergraduate student reference group data report, Fall 2019*. https://www.acha.org/NCHA/ACHA-NCHA_Data/Publications_and_Reports/NCHA/Data/Reports_ACHA-NCHAIII.aspx

Answer: c

2) What is the probability of a surveyed college student *not* having a hard time falling asleep during the last week? In other words, what is $P(D = 0)$ or $P(0 \text{ days})$?

Answer: 0.336

3) What is the probability of a surveyed college student having a hard time falling asleep on a *majority* of the days in the last week? That is, calculate $P(4 \text{ days or more})$.

Answer:
$P(4\, days\ or\ more) = P(4\, days) + P(5\, days) + P(6\, days) + P(7\, days) = 0.206$

<u>Questions 4–6</u>: During the 2020–2021 NBA season, the average free throw percentage for all players was 77.8%.[2] This means that, on average, the probability of making one free throw was 0.778 for NBA players.

Suppose we considered 10 free throw attempts by an NBA player whose free throw percentage is 77.8%. The following table displays the possible outcomes of these 10 free throw attempts and the probability associated with each outcome—assuming that each free throw attempt is independent.

M, **Number of free throws made**	$P(M)$
0	0.0000
1	0.0000
2	0.0002
3	0.0015
4	0.0092
5	0.0387
6	0.1131
7	0.2265
8	0.2977

[2] *NBA League averages - per game*. (n.d.). Basketball Reference. Retrieved March 26, 2021, from https://www.basketball-reference.com/leagues/NBA_stats_per_game.html

9	0.2318
10	0.0812

4) According to the table, what is the probability of the NBA player making all 10 free throws? Calculate P(10 free throws made) or $P(M = 10)$.

   Answer: 0.0812

5) According to the table, is the player more likely to make half of the free throws or all 10?

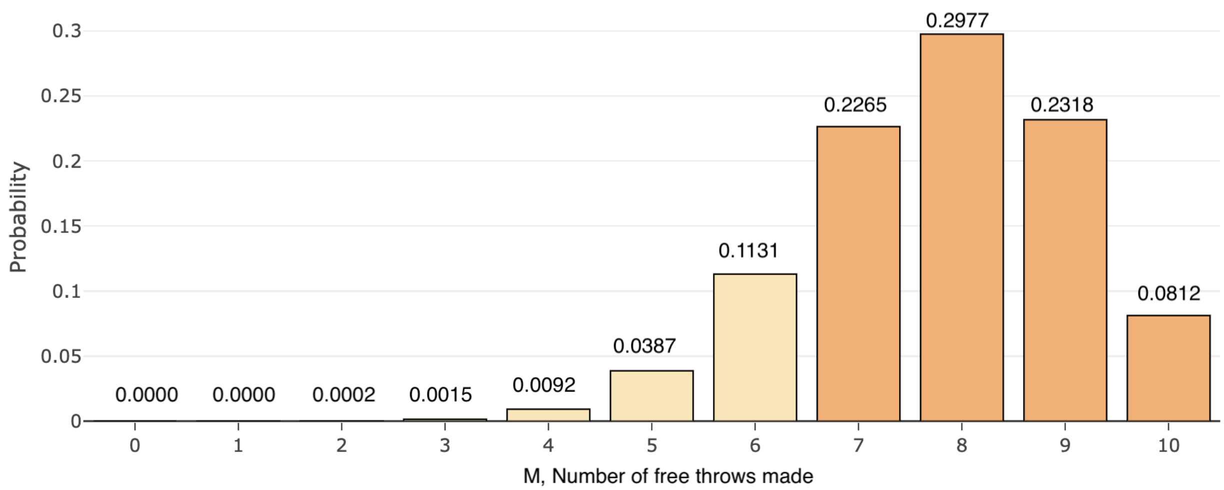
   a) They are more likely to make half of their free throws. The probability of making 5 free throws is greater than the probability of making 10 free throws.

   b) They are more likely to make 10 free throws. The probability of making 10 free throws is greater than the probability of making 5 free throws.

   c) They are equally likely to make half of their free throws as they are to make 10 free throws. The probability of making 5 free throws is equal to the probability of making 10 free throws.

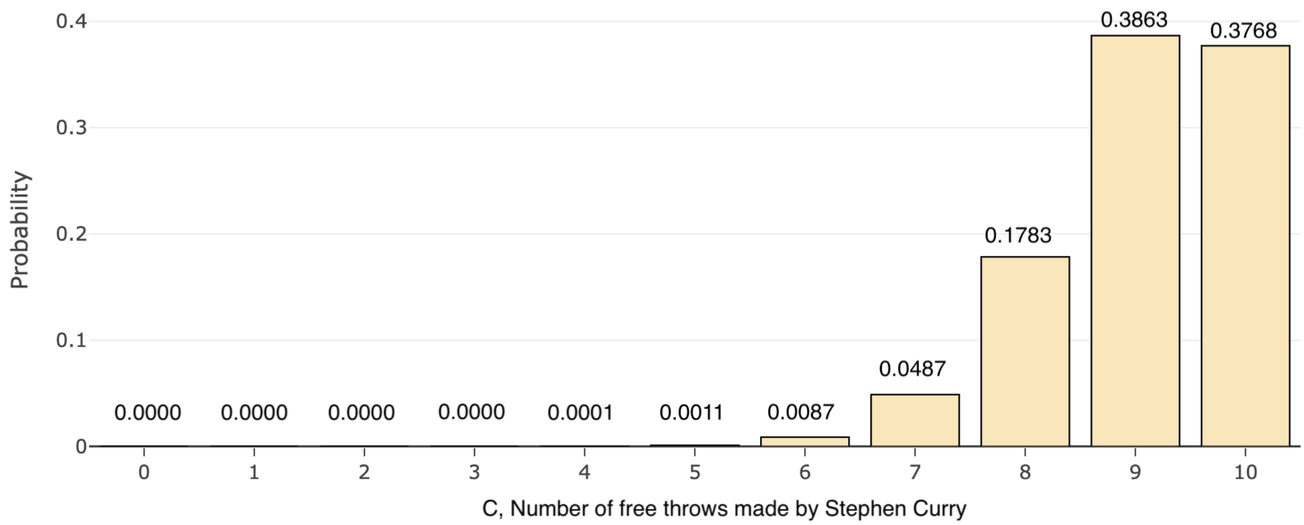
   Answer: b

6) The following graph displays the same values and probabilities associated with the random variable, M, in Questions 4 and 5 (number of free throws made in 10 attempts). What is the probability of the player making at least 7 free throws? The appropriate columns are shaded in the graph.



Answer: $P(at\ least\ 7\ free\ throws) = P(7) + P(8) + P(9) + P(10) = 0.8372$

<u>Questions 7–10</u>: NBA Basketball Player Stephen Curry has a better free throw percentage than the average for all NBA players.[3] Based on his free throw percentage of 90.7%, the following graph displays the possible values of attempting 10 free throws and the probability associated with each value—assuming each free throw is independent.



7) Compare the probability distribution for Stephen Curry with the probability distribution associated with a free throw average of 77.8% (i.e., the distribution described in Questions 4–6). What similarities and differences do you notice?

   Answers will vary.

   Sample answer: Both probability distributions suggest that the player with a free throw average of 77.8% and Stephen Curry are likely to make 7 or more free throws. This is reflected in the graphs by the taller bars for 7, 8, 9, and 10—compared to the bars associated with 6 free throws and fewer. Stephen Curry is less likely to make 5 or fewer free throws compared to the average NBA player. This is reflected by the very small probability values for 0 to 5 free throws.

8) How likely is it that Stephen Curry only makes exactly half of the 10 free throws? In other words, what is P(5 free throws made)?

   Answer: 0.0011

---

[3] Johnson, D. (2021, January 5). *Steph is on historic pace making free throws right now*. NBC Sports. https://www.nbcsports.com/bayarea/warriors/warriors-steph-curry-historic-pace-shooting-free-throw-line

9) In Question 6, you calculated the probability that an NBA player with a 77.8% free throw average makes at least 7 free throws. What is the probability of Stephen Curry making at least 7 free throws?

   Answer: $P(at\ least\ 7\ free\ throws) = P(7) + P(8) + P(9) + P(10) = 0.9901$

10) According to the probability graph, the probability of Stephen Curry making 3 or fewer free throws, P(3 free throws made or fewer), is 0. Do you think this means it would be *impossible* for Stephen Curry to make 3 or fewer free throws in 10 free throw attempts? If not, explain.

    Answers will vary.

    Sample answer: A probability of 0 suggests that the outcome would never occur. However, in this situation, the reason we find a sum of 0 is that the probabilities are extremely small. The probabilities in the graph are written to four decimal places, so the exact probability associated with each of these outcomes must be less than 0.0001. Thus, this outcome is not "impossible," just "improbable!"