

1. Determine if each of the following scenarios represents a binomial distribution. If it does, define n and p .
 - a. A flower seed packet states that 93% of seeds will successfully germinate. Seeds grow independently of other seeds. Sarah plants 5 seeds from this packet in her garden and after 2 weeks, counts the number of seeds that germinate.
 - b. A basketball player is practicing his free throws. All shots that he takes are from the same location under the same conditions. Historically, this player makes 74% of the free throws he attempts. He counts how many shots he makes until he misses one.
 - c. A surgical procedure has an 85% chance of success. A doctor performs the procedure on eight unrelated patients. We count the number of successful surgeries.

2. Lia is playing a carnival game in which she will attempt to toss 5 softballs into a basket. The game attendant tells her that historically, 27% of softballs are tossed successfully into the basket, and that the outcome of one toss does not affect the outcomes of other tosses. The game attendant will count the number of softballs that Lia tosses successfully into the basket out of 5 attempts.

- a. Is the scenario binomial? Explain.
- b. Find the probability that Lia tosses 3 softballs successfully into the basket. Show your work.
- c. Complete the table.

Number of successes						
Probability						

- d. Lia will win a prize if she successfully tosses at least four softballs into the basket. Find the probability that Lia wins a prize.

3. In clinical trials, 22% of patients taking a new weight loss medication experienced nausea after taking it. Twenty patients take part in a study where they are given this new weight loss medication. Let N represent the number of patients in the study who experience nausea. N follows a binomial distribution.
- Calculate and interpret the mean of the distribution of N .
 - Calculate and interpret the standard deviation of the distribution of N .
 - Find the probability that none of the patients in the study experience nausea after taking the medication. Show your work.
 - Find the probability that at least one patient in the study experiences nausea after taking the medication. Show your work.
4. X is a binomial random variable with $n = 12$ and $p = 0.3$. Calculate each of the following probabilities using technology.
- $P(X = 5)$
 - $P(X = 8 \text{ or } X = 9)$
 - $P(X \leq 4)$

5. Dante takes the bus to school each day. It is known from past experience that the bus is late to Dante's bus stop on 17% of days. Assuming daily bus arrivals are independent of one another, what is the probability that the bus will be late to Dante's bus stop at least 10 times out of the 21 school days this month?
- Define the random variable of interest and state how the random variable is distributed.
 - Find the probability.
6. At University A, 19% of undergraduate students have declared a major in Business, while 7% of undergraduate students at University B have declared a major in Business. A random sample of 250 students at University A and an independent random sample of 250 students at University B were selected. Assume students declare their major independently of one another. If the two samples are combined, what are the expected total number of students who have declared Business as a major and the standard deviation of the total number of students who have declared Business as a major respectively?
- 65 and 7.40
 - 65 and 10.24
 - 95 and 8.77
 - 95 and 12.41

7. The “horse race” is a popular carnival game in which multiple players shoot a stream of water at a target. Hitting the target moves their horse towards the finish line. The player whose horse crosses the finish line first is the winner. If 4 equally skilled players play the horse race game together, the probability that player A wins a given race is 0.25. In order to win a prize, Player A must win at least 60 percent of races in a series of n races. If the possible choices of n are 5, 10, and 20, which value of n should Player A choose in order to maximize their probability of winning a prize?
- A) $n = 5$
 - B) $n = 10$
 - C) $n = 20$
 - D) The probabilities are all the same, so it doesn't matter which n is chosen.