| Student: _____	Instructor: Bernard Omolo	Assignment: Binomial Probability
Date: _____	Course: DSA 8301 Spring 2023	Examples

1. In a binomial experiement, what does it mean to say that each trial is independent of the other trials?

   Choose the correct answer below.

   ○ **A.** Each trial is independent of the other trials if the outcome of one trial does not affect the outcome of any of the other trials.

   ○ **B.** Each trial is independent of the other trials if the outcome of one trial affects the outcome of another trial.

   ○ **C.** Each trial is independent of the other trials if no more than one trial occurs at a time.

   ○ **D.** Each trial is independent of the other trials if the sum of all the possible trial outcomes equals 1.

   Answer: A. Each trial is independent of the other trials if the outcome of one trial does not affect the outcome of any of the other trials.

2. The following histograms each represent binomial distributions. Each distribution has the same number of trials n but different probabilities of success p.
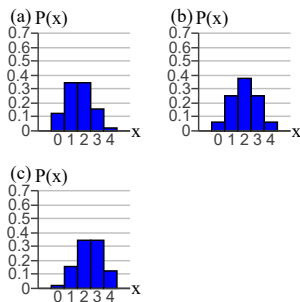
   Match p = 0.4, p = 0.5, p = 0.6 with the correct graph.

   ○ **A.** (a) p = 0.6, (b) p = 0.5, (c) p = 0.4
   ○ **B.** (a) p = 0.4, (b) p = 0.6, (c) p = 0.5
   ○ **C.** (a) p = 0.5, (b) p = 0.4, (c) p = 0.6
   ○ **D.** (a) p = 0.4, (b) p = 0.5, (c) p = 0.6
   ○ **E.** (a) p = 0.5, (b) p = 0.6, (c) p = 0.4
   ○ **F.** (a) p = 0.6, (b) p = 0.4, (c) p = 0.5

   Answer: D. (a) p = 0.4, (b) p = 0.5, (c) p = 0.6

3. Find the mean, variance, and standard deviation of the binomial distribution with the given values of n and p.

   n = 60, p = 0.6

   The mean, μ, is [____]. (Round to the nearest tenth as needed.)

   The variance, σ^2, is [____]. (Round to the nearest tenth as needed.)

   The standard deviation, σ, is [____]. (Round to the nearest tenth as needed.)

   Answers 36

   14.4

   3.8

4. Find the mean, variance, and standard deviation of the binomial distribution with the given values of n and p.

   n = 125, p = 0.77

   The mean, μ, is [____]. (Round to the nearest tenth as needed.)

   The variance, σ^2, is [____]. (Round to the nearest tenth as needed.)

   The standard deviation, σ, is [____]. (Round to the nearest tenth as needed.)

   Answers 96.3

   22.1

   4.7

5. About 20% of babies born with a certain ailment recover fully. A hospital is caring for five babies born with this ailment. The random variable represents the number of babies that recover fully. Decide whether the experiment is a binomial experiment. If it is, identify a success, specify the values of n, p, and q, and list the possible values of the random variable x.

Is the experiment a binomial experiment?

○ Yes

○ No

What is a success in this experiment?

○ Baby doesn't recover

○ Baby recovers

○ This is not a binomial experiment.

Specify the value of n. Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** n = [   ]

○ **B.** This is not a binomial experiment.

Specify the value of p. Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** p = [   ]

○ **B.** This is not a binomial experiment.

Specify the value of q. Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** q = [   ]

○ **B.** This is not a binomial experiment.

List the possible values of the random variable x.

○ x = 0, 1, 2,..., 5

○ x = 0, 1, 2,..., 4

○ x = 1, 2, 3,..., 5

○ This is not a binomial experiment.

Answers Yes

Baby recovers

A. n = [5   ]

A. p = [0.2   ]

A. q = [0.8   ]

x = 0, 1, 2,..., 5

6. A state lottery randomly chooses 7 balls numbered from 1 through 37 without replacement. You choose 7 numbers and purchase a lottery ticket. The random variable represents the number of matches on your ticket to the numbers drawn in the lottery. Determine whether this experiment is binomial. If so, identify a success, specify the values n, p, and q and list the possible values of the random variable x.

Is the experiment binomial?

- ○ **A.** No, because the probability of success is different for each trial.
- ○ **B.** Yes, there are a fixed number of trials and the trials are independent of each other.
- ○ **C.** Yes, the probability of success is the same for each trial.
- ○ **D.** No, there are more than two outcomes for each trial.

Identify a success. Choose the correct answer below.

- ○ **A.** A success is matching one of the numbers in the lottery.
- ○ **B.** A success is matching all of the numbers in the lottery.
- ○ **C.** A success is the number of matches on your ticket to the numbers drawn in the lottery.
- ○ **D.** The experiment is not binomial.

Specify the values n, p, and q. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ○ **A.** n = [_____], p = [_____], q = [_____]
  (Type integers or decimals.)
- ○ **B.** The experiment is not binomial.

List the possible values of the random variable x. Choose the correct answer below.

- ○ **A.** The possible values for x are 1, 2, ..., 7.
- ○ **B.** The possible values for x are 1, 2, 3, 4, ..., 37.
- ○ **C.** The experiment is not binomial.

Answers A. No, because the probability of success is different for each trial.

D. The experiment is not binomial.

B. The experiment is not binomial.

C. The experiment is not binomial.

---

7. 67% of U.S. adults have very little confidence in newspapers. You randomly select 10 U.S. adults. Find the probability that the number of U.S. adults who have very little confidence in newspapers is (a) exactly five, (b) at least six, and (c) less than four.

(a) P(5) = [_____] (Round to three decimal places as needed.)

(b) P(x ≥ 6) = [_____] (Round to three decimal places as needed.)

(c) P(x < 4) = [_____] (Round to three decimal places as needed.)

Answers 0.133

0.794

0.019

---

8. Seventy-five percent of consumers prefer to purchase electronics online. You randomly select 8 consumers. Find the probability that the number of consumers who prefer to purchase electronics online is (a) exactly five, (b) more than five, and (c) at most five.

(a) Find the probability that the number that prefer to purchase electronics online is exactly five.

P(5) = [   ]
(Round to three decimal places as needed.)

(b) Find the probability that the number that prefer to purchase electronics online is more than five.

P(x > 5) = [   ]
(Round to three decimal places as needed.)

(c) Find the probability that the number that prefer to purchase electronics online is at most five.

P(x ≤ 5) = [   ]
(Round to three decimal places as needed.)

Answers 0.208

0.679

0.321

9. 38% of college students say they use credit cards because of the rewards program. You randomly select 10 college students and ask each to name the reason he or she uses credit cards. Find the probability that the number of college students who say they use credit cards because of the rewards program is (a) exactly two, (b) more than two, and (c) between two and five inclusive. If convenient, use technology to find the probabilities.

(a) P(2) = [   ] (Round to the nearest thousandth as needed.)

(b) P(x > 2) = [   ] (Round to the nearest thousandth as needed.)

(c) P(2 ≤ x ≤ 5) = [   ] (Round to the nearest thousandth as needed.)

Answers 0.142

0.798

0.805

10. 37% of working mothers do not have enough money to cover their health insurance deductibles. You randomly select six working mothers and ask them whether they have enough money to cover their health insurance deductibles. The random variable represents the number of working mothers who do not have enough money to cover their health insurance deductibles. Complete parts (a) through (c) below.
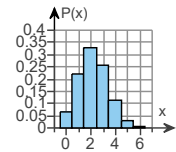

(a) Construct a binomial distribution using n = 6 and p = 0.37.

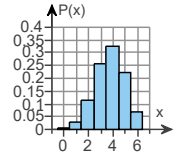| x	P(x)
0	
1	
2	
3	
4	
5	
6	

(Round to the nearest thousandth as needed.)

(b) Graph the binomial distribution using a histogram and describe its shape. Choose the correct graph below.
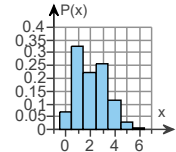
○ **A.**

○ **B.**

○ **C.**

Describe the shape of the histogram. Choose the correct answer below.

○ **A.** Symmetrical
○ **B.** Skewed left
○ **C.** Skewed right
○ **D.** None of these

(c) What values of the random variables would you consider unusual? Explain your reasoning.

The values x = 6 and x = [   ] would be unusual because their probabilities are (1) _____ 0.05.

(1) ○ less than
     ○ equal to
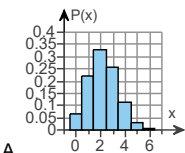   ○ greater than

Answers 0.063

0.220

0.323

0.253

0.112

0.026

0.003

A.

C. Skewed right

5

(1) less than

11. Seventy-three percent of adults want to live to age 100. You randomly select five adults and ask them whether they want to live to age 100. The random variable represents the number of adults who want to live to age 100. Complete parts (a) through (c) below.
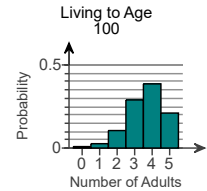
(a) Construct a binomial distribution.

x	P(x)
0	
1	
2	
3	
4	
5	

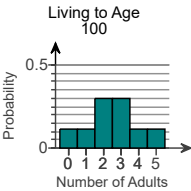(Round to five decimal places as needed.)

(b) Graph the binomial distribution using a histogram and describe its shape.

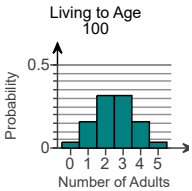Graph the binomial distribution. Choose the correct graph below.

○ **A.**

Living to Age 100

○ **B.**

Living to Age 100

○ **C.**

Living to Age 100

What is the shape of the histogram?

○ Skewed left

○ Symmetric

○ Skewed right

(c) What values of the random variable x would you consider unusual?

The value(s) (1) _____ would be unusual because the associated probability (probabilities) is(are) (2) _____ 0.05.

(1) ○ x = 0, x = 1, and x = 2   ○ x = 0   (2) ○ equal to

  ○ x = 4 and x = 5   ○ less than

  ○ x = 5   ○ more than

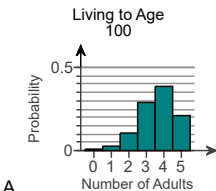 ○ x = 0 and x = 1

Answers 0.00143

  0.01940

  0.10489

  0.28359

  0.38338

  0.20731

Living to Age 100

A.

Skewed left

(1) x = 0 and x = 1

(2) less than

12. 78% of U.S. adults think that political correctness is a problem in America today. You randomly select six U.S. adults and ask them whether they think that political correctness is a problem in America today. The random variable represents the number of U.S. adults who think that political correctness is a problem in America today. Answer the questions below.

Find the mean of the binomial distribution.

$\mu =$ [   ]   (Round to the nearest tenth as needed.)

Find the variance of the binomial distribution.

$\sigma^2 =$ [   ]   (Round to the nearest tenth as needed.)

Find the standard deviation of the binomial distribution.

$\sigma =$ [   ]   (Round to the nearest tenth as needed.)

Interpret the results in the context of the real-life situation.

Most samples of 6 adults would differ from the mean by no more than [   ].
(Type integers or decimals rounded to the nearest tenth as needed.)

   Answers 4.7

           1.0

           1.0

           1.0

13. Sixty-three percent of adults in a certain country believe that life on other planets is plausible. You randomly select five adults and ask them whether they believe that life on other planets is plausible. The random variable represents the number of adults who believe that life on other planets is plausible. Find the mean, variance, and standard deviation of the binomial distribution for the random variable. Interpret the results.

Find the mean of the binomial distribution.

$\mu =$ [   ]   (Round to two decimal places as needed.)

Find the variance of the binomial distribution.

$\sigma^2 =$ [   ]   (Round to two decimal places as needed.)

Find the standard deviation of the binomial distribution.

$\sigma =$ [   ]   (Round to two decimal places as needed.)

Interpret the results.

On average, [   ] out of every 5 adults in the country believe that life on other planets is plausible. In most samples of 5 adults, the number of adults who think life on other planets is plausible would differ from the mean by no more than [   ].
(Type integers or decimals rounded to two decimal places as needed.)

   Answers 3.15

           1.17

           1.08

           3.15

           1.08

14. Eleven percent of U.S. employees who are late for work blame oversleeping. You randomly select four U.S. employees who are late for work and ask them whether they blame oversleeping. The random variable represents the number of U.S. employees who are late for work and blame oversleeping.

Find the mean of the binomial distribution.

$\mu =$ [   ]   (Round to the nearest hundredth as needed.)

Find the variance of the binomial distribution.

$\sigma^2 =$ [   ]   (Round to the nearest hundredth as needed.)

Find the standard deviation of the binomial distribution.

$\sigma =$ [   ]   (Round to the nearest hundredth as needed.)

Interpret the results in the context of the real-life situation.

In most samples of four adults are late for work, the average number of adults that blame oversleeping would differ from the mean by no more than [   ].
(Type an integer or decimal rounded to the nearest hundredth as needed.)

Answers 0.44

    0.39

    0.63

    0.63

---

15. According to a theory in genetics, if tall and colorful plants are crossed with short and colorless plants, four types of plants will result: tall and colorful, tall and colorless, short and colorful, and short and colorless, with corresponding probabilities of $\frac{5}{16}$, $\frac{4}{16}$, $\frac{1}{16}$, and $\frac{6}{16}$. In a multinomial experiment, if 10 plants are selected, find the probability that 5 will be tall and colorful, 3 will be tall and colorless, 1 will be short and colorful, and 1 will be short and colorless.
[1] Click the icon to view more information about a multinomial experiment.

The probability is [   ].
(Round to three decimal places as needed.)

1: Information about multinomial experiments.

A multinomial experiment is a probability experiment that satisfies the following conditions.

1. The experiment is repeated a fixed number of times n where each trial is independent of the other trials.
2. Each trial has k possible mutually exclusive outcomes: E_1, E_2, E_3, ..., E_k.
3. Each outcome has a fixed probability. So, $P(E_1) = p_1$, $P(E_2) = p_2$, $P(E_3) = p_3$, ..., $P(E_k) = p_k$. The sum of the probabilities for all outcomes is 1.

    $p_1 + p_2 + p_3 + ... + p_k = 1$
4. For any experiment, x_1 is the number of times E_1 will occur, x_2 is the number of times E_2 will occur, x_3 is the number of times E_3 will occur, and so on.
5. The discrete random variable x counts the number of times x_1, x_2, x_3, ..., x_k occurs in n independent trials where

    $x_1 + x_2 + x_3 + x_k = n$.

The probability that x will occur is given by the formula below.

$$P(x) = \frac{n!}{x_1!x_2!x_3!...x_k!} p_1^{x_1} p_2^{x_2} p_3^{x_3} ... p_k^{x_k}$$

Answer: 0.006