Student: ____________ **Date:** ____________	**Instructor:** Andreas Lazari **Course:** Math2620 F - Fall 2018	**Assignment:** Chapter 6.2-Homework

1. Determine if the following probability experiment represents a binomial experiment.

   A random sample of 15 college professors is obtained, and the individuals selected are asked to state their ages.

   Choose the correct answer below.

   - ● A. No, this probability experiment does not represent a binomial experiment because the variable is continuous, and there are not two mutually exclusive outcomes.
   - ○ B. Yes, this probability experiment represents a binomial experiment because the probability of success is the same for each trial of the experiment.
   - ○ C. No, this probability experiment does not represent a binomial experiment because the trials are not independent.
   - ○ D. Yes, this probability experiment represents a binomial experiment because each trial has two mutually exclusive outcomes.

2. Determine whether the following probability experiment represents a binomial experiment and explain the reason for your answer.

   An experimental drug is administered to 90 randomly selected individuals, with the number of individuals responding favorably recorded.

   Does the probability experiment represent a binomial experiment?

   - ○ A. No, because there are more than two mutually exclusive outcomes for each trial.
   - ● B. Yes, because the experiment satisfies all the criteria for a binomial experiment.
   - ○ C. No, because the probability of success differs from trial to trial.
   - ○ D. No, because the trials of the experiment are not independent.

3. Determine whether the following probability experiment represents a binomial experiment and explain the reason for your answer.

   Five cards are selected from a standard 52-card deck without replacement. The number of queens selected is recorded.

   Does the probability experiment represent a binomial experiment?

   - ○ A. Yes, because the experiment satisfies all the criteria for a binomial experiment.
   - ● B. No, because the trials of the experiment are not independent and the probability of success differs from trial to trial.
   - ○ C. No, because the experiment is not performed a fixed number of times.
   - ○ D. No, because there are more than two mutually exclusive outcomes for each trial.

4. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

   $n = 10,\ p = 0.4,\ x = 7$

   $P(X=7) = \text{binopdf}(10, 0.4, 7) = 0.042467328$

   $P(7) =$ 0.0425

   (Do not round until the final answer. Then round to four decimal places as needed.)

5. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 50$, $p = 0.98$, $x = 48$

$P(X=48) = \text{binopdf}(50, 0.98, 48) = 0.1858008572$

P(48) = 0.1858

(Do not round until the final answer. Then round to four decimal places as needed.)

6. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 8$, $p = 0.4$, $x = 4$

$P(X=4) = \text{binopdf}(8, 0.4, 4) = 0.2322432$

P(4) = 0.2322

(Do not round until the final answer. Then round to four decimal places as needed.)

7. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 9$, $p = 0.8$, $x \le 3$

$P(X \le 3) = \text{binocdf}(9, 0.8, 3) = 0.003066368$
≈ 0.0031

The probability of $x \le 3$ successes is 0.0031 (Round to four decimal places as needed.)

8. A binomial probability experiment is conducted with the given parameters. Use technology to find the probability of x successes in the n independent trials of the experiment. Use the Tech Help button for further assistance.

$n = 9$, $p = 0.35$, $x < 4$

$P(X<4) = P(X \le 3) = \text{binocdf}(9, .35, 3)$
$= 0.6088944135$
≈ 0.6089

P(X < 4) = 0.6089

(Round to four decimal places as needed.)

9. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

$n = 13$, $p = 0.35$, $x \le 4$

$P(X \le 4) = \text{binocdf}(13, 0.35, 4) = 0.500502732$
≈ 0.5005

The probability of $x \le 4$ successes is 0.5005. (Round to four decimal places as needed.)

10. According to an airline, flights on a certain route are on time 80% of the time. Suppose 15 flights are randomly selected and the number of on-time flights is recorded.

(a) Explain why this is a binomial experiment.
(b) Find and interpret the probability that exactly 10 flights are on time.
(c) Find and interpret the probability that fewer than 10 flights are on time.
(d) Find and interpret the probability that at least 10 flights are on time.
(e) Find and interpret the probability that between 8 and 10 flights, inclusive, are on time.

(a) Identify the statements that explain why this is a binomial experiment. Select all that apply.

- [ ] A. The experiment is performed until a desired number of successes is reached.
- [x] B. The experiment is performed a fixed number of times.
- [x] C. The trials are independent.
- [ ] D. Each trial depends on the previous trial.
- [x] E. The probability of success is the same for each trial of the experiment.
- [ ] F. There are three mutually exclusive possibly outcomes, arriving on-time, arriving early, and arriving late.
- [x] G. There are two mutually exclusive outcomes, success or failure.

$X \sim B(15, .8)$

(b) The probability that exactly 10 flights are on time is 0.1032.
(Round to four decimal places as needed.)

$P(X=10) = \text{binompdf}(15, .8, 10) = 0.1031822943 \approx 0.1032$

Interpret the probability.

In 100 trials of this experiment, it is expected about 10 to result in exactly 10 flights being on time.
(Round to the nearest whole number as needed.)

$100(0.1032) = = 10.32 \approx 10$

(c) The probability that fewer than 10 flights are on time is 0.0611.
(Round to four decimal places as needed.)

$P(X<10) = P(X \leq 9) = \text{binomcdf}(15, .8, 9) = 0.0610514296 \approx 0.0611$

Interpret the probability.

In 100 trials of this experiment, it is expected about 6 to result in fewer than 10 flights being on time.
(Round to the nearest whole number as needed.)

$100(0.0611) = 6.11 \approx 6$

(d) The probability that at least 10 flights are on time is 0.9389.
(Round to four decimal places as needed.)

$P(X \geq 10) = 1 - P(X \leq 9) = 1 - 0.0611 = 0.9389$

Interpret the probability.

In 100 trials of this experiment, it is expected about 94 to result in at least 10 flights being on time.
(Round to the nearest whole number as needed.)

$100 \times 0.9389 = 93.89 \approx 94$

(e) The probability that between 8 and 10 flights, inclusive, are on time is 0.16.
(~~Round to four decimal~~ places as needed.)

$P(8 \leq X \leq 10) = P(X \leq 10) - P(X \leq 7) = 0.164233 - 0.004239 = 0.159994 \approx 0.16$

Interpret the probability.

In 100 trials of this experiment, it is expected about 16 to result in between 8 and 10 flights, inclusive, being on time.
(Round to the nearest whole number as needed.)

$100 \times 0.16 = 16$

11. According to a study done by a university student, the probability a randomly selected individual will not cover his or her mouth when sneezing is 0.267. Suppose you sit on a bench in a mall and observe people's habits as they sneeze.

$X \sim B(16, .267)$

(a) What is the probability that among 16 randomly observed individuals exactly 7 do not cover their mouth when sneezing?
(b) What is the probability that among 16 randomly observed individuals fewer than 5 do not cover their mouth when sneezing?
(c) Would you be surprised if, after observing 16 individuals, fewer than half covered their mouth when sneezing? Why?

(a) The probability that exactly 7 individuals do not cover their mouth is 0.0676
(Round to four decimal places as needed.)

$P(X=7) = \text{binompdf}(16, .267, 7)$
$= 0.06759990$

(b) The probability that fewer than 5 individuals do not cover their mouth is 0.5685
~~(Round to four decimal places as needed.)~~

$P(X<5) = P(X \le 4) = 0.568476$
$= \text{binocdf}(16, .267, 4)$

(c) Fewer than half of 16 individuals covering their mouth (1) would be surprising because the probability of observing fewer than half covering their mouth when sneezing is 0.0118, which (2) is an unusual event.
(Round to four decimal places as needed.)

$X \sim B(16, 1-.267=0.733)$

$P(X \le 7) = \text{binocdf}(16, 0.733, 7)$
$= 0.0117879 \approx 0.0118$

(1) ○ would not
● would

(2) ○ is not
● is

12. According to an almanac, 70% of adult smokers started smoking before turning 18 years old. When technology is used, use the Tech Help button for further assistance.

$X \sim B(100, .7)$

(a) Compute the mean and standard deviation of the random variable X, the number of smokers who started before 18 in 100 trials of the probability experiment.
(b) Interpret the mean.
(c) Would it be unusual to observe 85 smokers who started smoking before turning 18 years old in a random sample of 100 adult smokers? Why?

(a) μ_x = 70

$E(X) = \mu_x = n \cdot p = 100(.7) = 70$

σ_x = 4.6 (Round to the nearest tenth as needed.)

$\sigma^2 = n \cdot p(1-p) = 100(.7)(.3) = 21$

$\sigma = \sqrt{21} = 4.582576 \approx 4.6$

(b) What is the correct interpretation of the mean?

● A. It is expected that in a random sample of 100 adult smokers, 70 will have started smoking before turning 18.

○ B. It is expected that in 50% of random samples of 100 adult smokers, 70 will have started smoking before turning 18.

○ C. It is expected that in a random sample of 100 adult smokers, 70 will have started smoking after turning 18.

(c) Would it be unusual to observe 85 smokers who started smoking before turning 18 years old in a random sample of 100 adult smokers? Hint: Compute the probability of P(X= 85).

$P(X=85) = \text{binopdf}(100, .7, 85)$
$= 2.476585738E^{-4}$
$= 0.0002476585738$
≈ 0.0002

○ A. Yes, because 85 is ot the mean.

○ B. No, the because 85 is not the mean.

● C. Yes, because 85 is an unusual value(low probability).

○ D. No, because 85 is an unusual value(low probability).

13. Suppose that a recent poll found that 49% of adults believe that the overall state of moral values is poor. Complete parts (a) through (c).

$X \sim B(100, .49)$

(a) For 100 randomly selected adults, compute the mean and standard deviation of the random variable X, the number of adults who believe that the overall state of moral values is poor.

The mean of X is 49. (Round to the nearest whole number as needed.)

The standard deviation of X is 5.0. (Round to the nearest tenth as needed.)

$\mu_X = E(X) = n \cdot p = (100)(.49)$

$\simeq 49.$

$\sigma^2 = n \cdot p \cdot (1-p) = 100(.49)(.51)$

$\boxed{\sigma^2 = 24.99}$

$\sigma = \sqrt{24.99}$

$\sigma = 4.998999$

$\simeq 5.0.$

(b) Interpret the mean. Choose the correct answer below.

- ○ A. For every 49 adults, the mean is the maximum number of them that would be expected to believe that the overall state of moral values is poor.
- ● B. For every 100 adults, the mean is the number of them that would be expected to believe that the overall state of moral values is poor.
- ○ C. For every 100 adults, the mean is the range that would be expected to believe that the overall state of moral values is poor.
- ○ D. For every 100 adults, the mean is the minimum number of them that would be expected to believe that the overall state of moral values is poor.

(c) Would it be unusual if 57 of the 100 adults surveyed believe that the overall state of moral values is poor?

- ● No
- ○ Yes

$P(X=57) = \text{binopdf}(100, .49, 57)$

$\simeq 0.022227$

Since $n \cdot p(1-p) = 24.99 \geq 10$

then the interval $\mu - 2\sigma$ to $\mu + 2\sigma$ gives an interval of "usual" observations.

Interval: $(49 - 2(5)$ to $49 + 2(5))$

$(39$ to $59)$

Since, 57 is in the interval of usual values

the 57 is Not an unusual Value,

1. A.
No, this probability experiment does not represent a binomial experiment because the variable is continuous, and there are not two mutually exclusive outcomes.

2. B. Yes, because the experiment satisfies all the criteria for a binomial experiment.

3. B. No, because the trials of the experiment are not independent and the probability of success differs from trial to trial.

4. 0.0425

5. 0.1858

6. 0.2322

7. 0.0031

8. 0.6089

9. 0.5005

10. B. The experiment is performed a fixed number of times., C. The trials are independent., E. The probability of success is the same for each trial of the experiment., G. There are two mutually exclusive outcomes, success or failure.

    0.1032

    10

    0.0611

    6

    0.9389

    94

    0.1600

    16

11. 0.0676

    0.5685

    (1) would

    0.0118

    (2) is

12. 70

4.6

A. It is expected that in a random sample of 100 adult smokers, 70 will have started smoking before turning 18.

C. Yes, because 85 is an unusual value(low probability).

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13. 49

5.0

B.

For every 100 adults, the mean is the number of them that would be expected to believe that the overall state of moral values is poor.

No
