Name:_____ **Date:**_____

Chapter 8 Review #1: Binomial and Geometric Distributions

1. A fair coin is to be flipped 5 times. The first 4 flips land "heads" up. What is the probability of "heads" on the next (5^{th}) flip of this coin?

a) 100% because it is likely to repeat
b) Less than 50%, because according to the Law of Large Numbers the number of heads will gravitate towards 50% as the number of flip increases
c) 50% because each flip is independent
d) $5C_1\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)$
e) $\left(\frac{1}{2}\right)^5$

2. Which of the following could be quantified as a binomial random variable?

a) The number of persons in an emergency room

b) The weights of truck arriving at a weight station

c) Whether or not a student wears glasses

d) The square foot areas of houses being built in Preston Hollow

e) The first time you get a speeding ticket

3. Historically, only 35% of applicants for a statistical programming internship at a large pharmaceutical company have previous experience with the necessary software. Assume that applicants are selected at random and interviewed sequentially. What is the probability it takes exactly four interviews to find the first applicant with previous experience?

a) 0.0150 b) 0.0279 c) 0.0961 d) 0.1115 e) 0.3845

4. Which of the following variables is geometric?
a) The number of times I have to roll a die to get two 6's
b) The number of cards I deal from a well-shuffled deck of 52 cards until I get a heart
c) The number of digits I read in a randomly selected row of random digits table until I find a 7
d) The number of 7's in a row of 40 random digits
e) The number of 6's I get if I roll a die 10 times

5. Seventeen people have been exposed to a particular disease. Each one independently has a 40% chance of contracting the disease. A hospital has the capacity to handle 10 cases of the disease. What is the probability that the hospital's capacity will be exceeded?
a) 0.011 b) 0.035 c) 0.092 e) 0.989

6. The figure shows the probability distribution of a discrete random variable "X". Which of the following best describes this random variable?

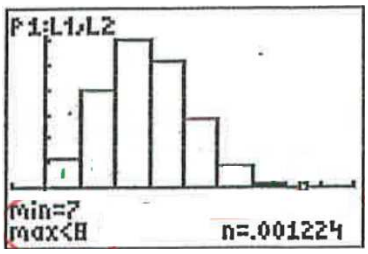
   A) Binomial with n=8 and p=0.1

   B) Binomial with n=8 and p=0.3

   C) Binomial with n=8 and p=0.8

   D) Geometric with p=0.1

   E) Geometric with p=0.2



7. Jim reads that 1 out of 4 eggs contains salmonella bacteria. So he never uses more than 3 eggs in cooking. If eggs do or don't contain salmonella independently of each other, the number of contaminated eggs when Jim uses 3 chosen at random has the following distributions:

a) Binomial; n=4, $p=\frac{1}{4}$ b) Binomial; n=3, $p=\frac{1}{4}$ c) Binomial; n=4, $p=\frac{1}{3}$ d) Geometric; $p=\frac{1}{4}$

8. In the previous problem, the probability that at least 1 of Joe's eggs contains salmonella is about:
   a) 0.084 b) 0.68 c) 0.58 d) 0.42 e) 0

9. In which of the following situations would it be appropriate to use a Normal distribution to approximate probabilities for a binomial distribution with the given values of "n" and "p"?
   a) $n=10, p=0.5$ b) $n=40, p=0.88$ c) $n=100, p=0.2$ d) $n=100, p=0.99$
   e) $n=1000, p=0.003$

10. A 12-sided die has faces, which are numbered from 1 to 12. Assuming that the die is fair (that is, each face is equally likely to appear each time), which of the following would give the exact probability of getting 10 3's out of 50 rolls?

a) $50C_{10}(0.083)^{40}(0.917)^{10}$ b) $50C_{10}(0.083)^{10}(0.917)^{40}$

c) $12C_{10}(0.083)^{10}(0.917)^{2}$ d) $10(0.083)^{3}(0.917)^{7}$ e) $(0.083)^{10}(0.917)^{40}$

11. Suppose the probability that a softball player gets a hit in any single at – bat is 0.300. Assuming that her chance of getting a hit on a particular time at bat is independent of her other at bats, what is the probability that she will not get a hit until her fourth time at bat in a game?

a) $4C_3(0.3)(0.7)^3$ b) $4C_3(0.3)^3(0.7)$ c) $4C_1(0.3)^3(0.7)$ d) $(0.3)^3(0.7)$ e) $(0.3)(0.7)^3$

12. Which of the following is NOT a condition for a geometric setting?

a) There are only two possible outcomes for each trial
b) The probability of success is the same for each trial
c) The trials are independent
d) There are a fixed number of observations
e) The variable of interest is the number of trials required to reach the first success

13. Which of the following is a true statement?

(a) The binomial setting requires that there are only two possible outcomes for each trial, while the geometric setting permits more than two outcomes.

(b) A geometric random variable takes on integer values from 0 to n.

(c) If X is a geometric random variable and the probability of success is 0.85, then the probability distribution of X will be skewed left, since 0.85 is closer to 1 than to 0.

(d) An important difference between binomial and geometric random variables is that there is a fixed number of trials in a binomial setting, and the number of trials varies in a geometric setting.

(e) The distribution of every binomial random variable is skewed right.

14. In order for the random variable "X" to have a geometric distribution, which of the following conditions must "X" satisfy?

i) $0 < P < 0.5$
ii) II) The number of trials is fixed
iii) Trials are independent
iv) The probability of success has to be the same for each trial
v) All outcomes in the sample space are equally likely

a) III and IV b) II, III, IV, and V c) I and III d) I, III, and V e) II and III

15. While hiking in the words, you and your friends are abducted by aliens. The aliens want to study the human race, so they will place you in one of two groups based on your results of a ten question True/False test. Unfortunately, since you don't understand their language, you'll have to guess at the answers. Based on your observations of the people who were tested before you, if you get less than 8 correct, you are placed in the experimentation group. What is the probability that you will escape the experimentation?
    a) 0.0107 b) 0.9893 c) 0.9453 d) 0.0547 e) 0.0439

16. IF "X" is a binomial random variable with "n = 10" and "p = 0.25" then:

a) $\sigma_x = 1.875$ b) $\sigma_x = \sqrt{2.5}$ c) $\sigma_x = \sqrt{1.875}$ d) $\sigma_x = 2.5$ e) $\sigma_x = 4$

17. A study shows that 66% of all dog owners greet their dog before they greet their spouse or childen when they get home from work. Assume that the claim is true and each arrival home is independent.
    a) In a series of arriving home from work, what is the probability that the first time a person doesn't greet their dog first is on the 5th arrival home?

    b) What is the probability that a person greets their dog first on 4 or fewer arrivals home on the next 10 arrival homes?

    c) Suppose that a person goes on vacation for two weeks. When he returns, he greets his dog first only two out of 10 days. Is this evidence that his rate is now less than 66%? Explain:

1C	2c	3c	4c	5b	6b	7b	8c	9c	10b
11e	12d	13d	14A	15D	16C	17a) 16.45%	17b) 8.36%	17C) 0.35%	

10. Suppose you toss two fair, four-sided dice whose faces are labeled 1, 2, 3, and 4. Let $\bar{X}$ represent the average of the two sides that are facing up. Which of the following is the sampling distribution of $\bar{X}$?

(A)

$\bar{X}$	1	1.5	2	2.5	3	3.5	4
Probability	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{16}$

(B)

$\bar{X}$	1	1.5	2	2.5	3	3.5	4
Probability	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$

(C)

$\bar{X}$	2	3	4	5	6	7	8
Probability	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{16}$

(D)

$\bar{X}$	2	3	4	5	6	7	8
Probability	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$

Done

Multiple choice: Select the best answer for Exercises 101 to 105.

101. Joe reads that 1 out of 4 eggs contains salmonella bacteria. So he never uses more than 3 eggs in cooking. If eggs do or don't contain salmonella independently of each other, the number of contaminated eggs when Joe uses 3 chosen at random has the following distribution:

(a) binomial; $n = 4$ and $p = 1/4$
(b) binomial; $n = 3$ and $p = 1/4$
(c) binomial; $n = 3$ and $p = 1/3$
(d) geometric; $p = 1/4$
(e) geometric; $p = 1/3$

n = 3 EGGS
p = 1/4 = .25
binomial bad or NOT independent stated

102. In the previous exercise, the probability that at least 1 of Joe's 3 eggs contains salmonella is about

(a) .0.84. (b) 0.68. (c) 0.58. (d) 0.42. (e) 0...

P(at least 1 of 3 bad) = 1 − P(None) = $1 - (.75)^3 = .578$

105. In which of the following situations would it be appropriate to use a Normal distribution to approximate probabilities for a binomial distribution with the given values of n and p? Check np + nq ≥ 10

(a) $n = 10, p = 0.5$ $10(.5) = 5$ X
(b) $n = 40, p = 0.88$ $40(.12) = 4.8$ X
(c) $n = 100, p = 0.2$ BOTH check
(d) $n = 100, p = 0.99$ $100(.01) = 1$ X
(e) $n = 1000, p = 0.003$ $1000(.003) = 3$ X

np = 100(.2) = 20 ≥ 10 ✓
nq = 100(.8) = 80 ≥ 10 ✓

T6.7. Which of the following random variables is geometric?

(a) The number of times I have to roll a die to get two 6s.

(b) The number of cards I deal from a well-shuffled deck of 52 cards until I get a heart.

(c) The number of digits I read in a randomly selected row of the random digits table until I find a 7. LOOKING FOR THE 1ST occurrence of 7

(d) The number of 7s in a row of 40 random digits.

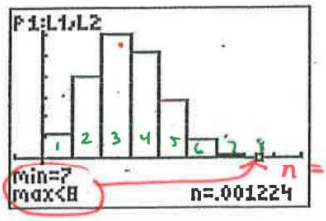
(e) The number of 6s I get if I roll a die 10 times.

T6.8. Seventeen people have been exposed to a particular disease. Each one independently has a 40% chance of contracting the disease. A hospital has the capacity to handle 10 cases of the disease. What is the probability that the hospital's capacity will be exceeded?

(a) 0.011 (b) 0.035 (c) 0.092 (d) 0.965 (e) 0.989

$n = 17$ → $P(X > 10) = 1 - P(X \leq 10)$

T6.9. The figure shows the probability distribution of a discrete random variable X. Which of the following best describes this random variable?



(a) Binomial with $n = 8, p = 0.1$

(b) Binomial with $n = 8, p = 0.3$

(c) Binomial with $n = 8, p = 0.8$

(d) Geometric with $p = 0.1$

(e) Geometric with $p = 0.2$

Geometric is typically skewed

8. A study shows that 66% of all dog owners greet their dog before they greet their spouse or children when they get home from work. Assume that the claim is true and each arrival home is independent.

(a) In a series of arriving home from work, what is the probability that the first time a person doesn't greet their dog first is on the 5th arrival home.

$(.66)^4(.34) = 0.0645$ geometricpdf(.34, 5) (prob doesn't greet, trial #)

6.45% chance that a person doesn't greet their dog first is the 5th night.

(b) What is the probability that a person greets their dog first on 4 or fewer of the arrivals home?

$P(X \leq 4)$ binomial next 10

binomialcdf(10, .66, 4) = 0.0836 (trials, prob greeting dog, max # of successes)

8.36% chance a person greets their dog first 4 or less times out of 10.

(c) Suppose that a person goes on vacation for two weeks. When he returns, he greets his dog first only two out of ten days. Is this evidence that his rate is now less than 66%? Explain.

$P(X = 2)$ binomialpdf(10, .66, 2) = 0.0035 (trials, success rate, # of successes)

0.35% chance that would happen so either the rate changed or there was