

Name _____

Date _____

AP Statistics - Mr. Bannon

Period _____

Unit 8 Review
Part I - Multiple choice

1) Approximately 3 in 10,000 people will develop a certain skin problem each year. In a group of 1000 people, what is the probability that at least 2 people will develop the skin problem next year?

- A. 0.033
- B. 0.037
- C. 0.259
- D. 0.741
- E. 0.963

2) A 12-sided die has faces numbered from 1-12. Assuming 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 at least 10 3s out of 50 rolls?

(a) $\binom{50}{0}(0.083)^0(0.917)^{50} + \binom{50}{1}(0.083)^1(0.917)^{49} + \dots + \binom{50}{9}(0.083)^9(0.917)^{41}$.

(b) $\binom{50}{11}(0.083)^{11}(0.917)^{39} + \binom{50}{12}(0.083)^{12}(0.917)^{38} + \dots + \binom{50}{50}(0.083)^{50}(0.917)^0$.

(c) $1 - \left[\binom{50}{0}(0.083)^0(0.917)^{50} + \binom{50}{1}(0.083)^1(0.917)^{49} + \dots + \binom{50}{10}(0.083)^{10}(0.917)^{40} \right]$.

(d) $1 - \left[\binom{50}{0}(0.083)^0(0.917)^{50} + \binom{50}{1}(0.083)^1(0.917)^{49} + \dots + \binom{50}{9}(0.083)^9(0.917)^{41} \right]$.

(e) $\binom{50}{0}(0.083)^0(0.917)^{50} + \binom{50}{1}(0.083)^1(0.917)^{49} + \dots + \binom{50}{10}(0.083)^{10}(0.917)^{40}$.

3) Twenty percent of all trucks undergoing a certain inspection will fail the inspection. Assume that trucks are independently undergoing this inspection, one at a time. The expected number of trucks inspected before a truck fails inspection is

a) 2

b) 4

c) 5

d) 20

e) Cannot be determined

- 4) Which of the following is not a common characteristic of binomial and geometric experiments?
- (a) There are exactly two possible outcomes: success or failure.
 - (b) There is a random variable X that counts the number of successes.
 - (c) Each trial is independent (knowledge about what has happened on previous trials gives you no information about the current trial).
 - (d) The probability of success stays the same from trial to trial.
 - (e) $P(\text{success}) + P(\text{failure}) = 1$.

Part II - Free Response

- 1) A brake inspection station reports that 15% of all cars tested have brakes in need of replacement pads. For a sample of 20 cars that come to the inspection station,
- (a) what is the probability that exactly 3 have defective breaks?
 - (b) what is the mean and standard deviation of the number of cars that need replacement pads?
- 2) The probability of winning a bet on red in roulette is 0.474. The binomial probability of winning money if you play 10 games is 0.31 and drops to 0.27 if you play 100 games. Use a normal approximation to the binomial to estimate your probability of coming out ahead (that is, winning more than $1/2$ of your bets) if you play 1000 times. Justify being able to use a normal approximation for this situation.

- 3) The coin of problem #1 is flipped 50 times. Let X be the number of heads. What is
- (a) the probability of *exactly* 20 heads?
 - (b) the probability of *at least* 20 heads?

- 4) The probability that a person recovers from a particular type of cancer operation is 0.7. Suppose 8 people have the operation. What is the probability that
- (a) exactly 5 recover?
 - (b) they all recover?
 - (c) at least one of them recovers?

- 5) At a school better known for football than academics (a school its football team can be proud of), it is known that only 20% of the scholarship athletes graduate within 5 years. The school is able to give 55 scholarships for football. What are the expected mean and standard deviation of the number of graduates for a group of 55 scholarship athletes?

6) An airline, believing that 5% of passengers fail to show up for flights, overbooks (sells more tickets than there are seats). Suppose a plane will hold 265 passengers, and the airline sells 275 seats. What's the probability the airline will not have enough seats so someone gets bumped?

7) An orchard owner knows that he'll have to use about 6% of the apples he harvests for cider because they will have bruises or blemishes. He expects a tree to produce about 300 apples.

a. Is this problem binomial or geometric? Why?

a. Find the probability there will be no more than a dozen cider apples?

b. Is it likely there will be more than 50 cider apples? Explain.

8) **POLLING** Many local polls of public opinion use samples of size 400 to 800. Consider a poll of 400 adults in Richmond that asks the question “Do you approve of President George W. Bush’s response to the World Trade Center terrorists attacks in September 2001?” Suppose we know that President Bush’s approval rating on this issue nationally is 92% a week after the incident.

(a) What is the random variable X ? Is X binomial? Explain.

X = the number of people in the sample of 400 adult Richmonders who approve of the President’s reaction.

(b) Calculate the binomial probability that at most 358 of the 400 adults in the Richmond poll answer “Yes” to this question.

(c) Find the expected number of people in the sample who indicate approval. Find the standard deviation of X .

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(d) Perform a normal approximation to answer the question in (b), and compare the results of the binomial calculation and the normal approximation. Is the normal approximation satisfactory?

9. Vitamin D is essential for strong, healthy bones. Our bodies produce vitamin D naturally when sunlight falls upon the skin, or it can be taken as a dietary supplement. Although the bone disease rickets was largely eliminated in England during the 1950s, some people there are concerned that this generation of children is at increased risk because they are more likely to watch TV or play computer games than spend time outdoors. Recent research indicated that about 20% of British children are deficient in vitamin D. Suppose doctors test a group of elementary school children.
- What's the probability that the first vitamin-D deficient child is the 8th one tested?
 - What's the probability that the first 10 children tested are all okay?
 - How many kids do they expect to test before finding one who has this vitamin deficiency?
 - They will test 50 students at the 3rd grade level. Find the mean and standard deviation of the number who may be deficient in vitamin D.
 - A news report said, "Only 5 children out of 50 tested were found to be deficient." Do you agree with this statement? Defend your answer statistically.
 - If they test 320 children at this school, what's the probability that no more than 50 of them have the vitamin deficiency?

10) **BINOMIAL SETTING?** In each situation below, is it reasonable to use a binomial distribution for the random variable X ? Give reasons for your answer in each case.

(a) An auto manufacturer chooses one car from each hour's production for a detailed quality inspection. One variable recorded is the count X of finish defects (dimples, ripples, etc.) in the car's paint.

(b) The pool of potential jurors for a murder case contains 100 persons chosen at random from the adult residents of a large city. Each person in the pool is asked whether he or she opposes the death penalty; X is the number who say "Yes."

(c) Joe buys a ticket in his state's "Pick 3" lottery game every week; X is the number of times in a year that he wins a prize.