

Name \_\_\_\_\_

Instructor \_\_\_\_\_

You have 120 minutes for this exam. You may use your calculator and the provided copy of the textbook formula card. No other notes are permitted. This exam will be scored out of 100 points and is worth 25% of your final grade. Each problem is equally weighted.

This exam has two parts

Part I - Ten multiple choice questions

Part II - Ten open ended questions - you must carefully and completely show your work

**INSTRUCTIONS PART I:** Questions 1 - 10, Multiple choice. Answer all TEN questions and circle the correct answer.

- 1) A quiz consists of 190 true or false questions. If the student guesses on each question, what is the mean number of correct answers?
  - A) 0
  - B) 190
  - C) 95
  - D) 38
  
- 2) The principal at Riverside High School would like to estimate the mean length of time each day that it takes all the buses to arrive and unload the students. How large a sample is needed if the principal would like to assert with 99% confidence that the sample mean is off by, at most, 6 minutes. Assume  $\sigma = 10$  minutes.
  - A) 20
  - B) 18
  - C) 19
  - D) 21
  
- 3) The average score of all golfers for a particular course has a mean of 66 and a standard deviation of 5. Suppose 100 golfers played the course today. Find the probability that the average score of the 100 golfers exceeded 67.
  - A) 0.0228
  - B) 0.3707
  - C) 0.4772
  - D) 0.1293

4) A survey of 100 fatal accidents showed that in 32 cases the driver at fault was inadequately insured. Find a point estimate for  $p$ , the population proportion of accidents where the driver at fault was inadequately insured.

- A) 0.32
- B) 0.68
- C) 0.471
- D) 0.242

5) Suppose a particular outcome from a random event has a probability of 0.02. Which of the following statements represents the correct interpretation of this probability?

- A) The outcome will never happen.
- B) The outcome will certainly happen two times out of every 100 trials.
- C) The outcome could happen, or it couldn't, the chances of either result are the same.
- D) The outcome is expected to happen about two times out of every 100 trials.

6) If the level of significance is 0.05, and the P-value is 0.043, the decision would be to

- A) fail to reject  $H_0$ .
- B) make no decision because the difference between the level of significance and the P-value is not statistically significant.
- C) use a nonparametric test because normality of the data cannot be established when the results are close.
- D) reject  $H_0$ .

7) One of the items on a student survey for an introductory statistics course was "Rate your intelligence on a scale of 1 to 10." The distribution of this variable for the 100 women in the class is presented below. What is the probability of randomly selecting a woman from the class who has an intelligence rating that is LESS than seven?

Intelligence Rating	Count
5	12
6	24
7	38
8	23
9	2
10	1

- A)  $38 / 100 = 0.38$
- B)  $( 12 + 24 ) / 100 = 0.36$
- C)  $( 12 + 24 + 38 ) / 100 = 0.74$
- D)  $( 23 + 2 + 1 ) / 100 = 0.26$
- E) None of the above.

8) A researcher obtained a random sample of 100 smokers and a random sample of 100 nonsmokers. After interviewing all 200 participants in the study, the researcher compared the rate of depression among the smokers with the rate of depression among nonsmokers. Determine which type of study is described.

- A) observational study
- B) scientific distribution
- C) probability sample
- D) experiment

9) The data below are the final exam scores of 10 randomly selected history students and the number of hours they slept the night before the exam.

Find the equation of the regression line for the given data, reporting coefficients to the nearest hundredth.

What would be the predicted score for a history student who slept 7 hours the previous night? Round your answer to the nearest whole number.

Is this a reasonable question?

Hours, x	3	5	2	8	2	4	4	5	6	3
Scores, y	65	80	60	88	66	78	85	90	90	71

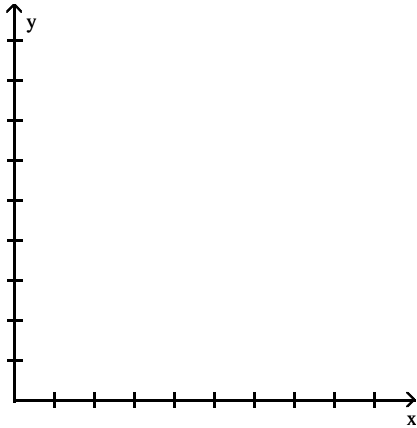
- A)  $\hat{y} = 5.04x + 56.11$ ; 91; Yes, it is reasonable.
- B)  $\hat{y} = 5.04x + 56.11$ ; 91; No, it is not reasonable. 7 hours is well outside the scope of the model.
- C)  $\hat{y} = -5.04x + 56.11$ ; 21; No, it is not reasonable. 7 hours is well outside the scope of the model.
- D)  $\hat{y} = -5.04x + 56.11$ ; 21; Yes, it is reasonable.

10) To win at LOTTO in a certain state, one must correctly select 6 numbers from a collection of 50 numbers (one through 50.) The order in which the selections is made does not matter. How many different selections are possible?

- A) 13,983,816
- B) 300
- C) 720
- D) 15,890,700

**INSTRUCTIONS PART II:** Questions 11 - 20, Short Response. Answer all TEN questions, carefully and completely showing your work and clearly indicating your answer.

11) Draw a scatter diagram for which  $r = 1$ .



12) The Environmental Protection Agency (EPA) uses a measure called the Pollutant Standards Index (PSI) to measure air quality in a city. A PSI reading over 100 indicates a day when the air quality is considered unhealthy. The measurements represent the number of days in 1995 that the PSI was over 100 for twenty metropolitan areas in the U.S. Midwest.

0, 0, 0, 1, 1, 1, 1, 1, 2, 2, 3, 4, 4, 4, 4, 5, 7, 7, 11, 14

Determine the five-number summary for the data.

Construct a boxplot for the data showing outliers if any. You must show all the calculations needed to determine if there are outliers.

13) A local bank needs information concerning the savings account balances of its customers. A random sample of 16 accounts was checked. The mean balance was \$786.75 with a standard deviation of \$156.20. Find a 98% confidence interval for the true mean. Assume that the account balances are normally distributed. Report your confidence intervals rounded to the nearest cent.

Find the appropriate critical value for  $t_{\alpha/2}$  or  $z_{\alpha/2}$  and report it: \_\_\_\_\_

Compute the margin of error (show your work):

Report the confidence interval:

14) The following table records the number of movies released by each distributor in 2008 (from [www.the-numbers.com](http://www.the-numbers.com)).

DISTRIBUTER	MOVIES
Warner Bros.	31
Paramount Pictures	17
Sony Pictures	18
Universal	21
20th Century Fox	24
Buena Vista	19
Lionsgate	19
Fox Searchlight	9
Summit Entertainment	5
Focus Features	8

(a) Determine the mean and median number of movies released by a distributor in 2008. Round your answers to the nearest tenth.

(b) Determine the standard deviation and range of the number of movies released by a distributor in 2008. Round your answers to the nearest tenth.

**Test the given claim using the classical approach to hypothesis testing. Identify the null and alternative hypotheses, test statistic, critical value(s), conclusion about the null hypothesis, and final conclusion that addresses the original claim.**

15) A local juice manufacturer distributes juice in bottles labeled 32 ounces. A government agency thinks that the company is cheating its customers. The agency selects 35 of these bottles, measures their contents, and obtains a sample mean of 31.7 ounces with a standard deviation of 0.70 ounce. Use a 0.01 significance level to test the agency's claim that the company is cheating its customers.

**Null Hypothesis:**

**Alternative Hypothesis:**

**Test Statistic:**

**Critical Value(s):**

**Conclusion about the Null Hypothesis:**

**Conclusion addressing the original claim:**

**16)** A university dean is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 118 of them are receiving financial aid. Use a 99% confidence interval to estimate the true proportion of students on financial aid. Round your result to the nearest hundredth.

Find the appropriate critical value for  $t_{\alpha/2}$  or  $z_{\alpha/2}$  and report it: \_\_\_\_\_

Compute the margin of error (show your work):

Report the confidence interval:

**17)** A human gene carries a certain disease from the mother to the child with a probability rate of 35%. That is, there is a 35% chance that the child becomes infected with the disease. Suppose a female carrier of the gene has five children. Assume that the infections of the five children are independent of one another. Find the probability that at least one of the children get the disease from their mother. Round your answer to the nearest thousandth.

**Test the given claim using the P-value method of hypothesis testing. Identify the null and alternative hypotheses, test statistic, P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.**

18) A card company claims that 80% of all American college students send a card to their mother on Mother's Day. Suppose you plan to gather your own data to test this claim. You select a simple random sample of 150 American college students to determine the proportion of them who send a card to their mother on Mother's Day. Your sample indicates that 70% of the students sampled send a card to their mother on Mother's Day. Does this make you accept or reject the card companies claim? Carefully justify your answer using a 0.05 significance level.

**Null Hypothesis:**

**Alternative Hypothesis:**

**Test Statistic:**

**P-value:**

**Conclusion about the Null Hypothesis:**

**Conclusion addressing the original claim:**



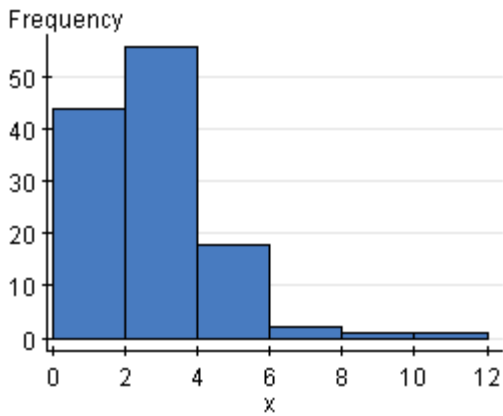
19) Choose the graph that best matches each variable described and write the letter in the blank.

\_\_\_ 200 rolls of a fair six-sided die.

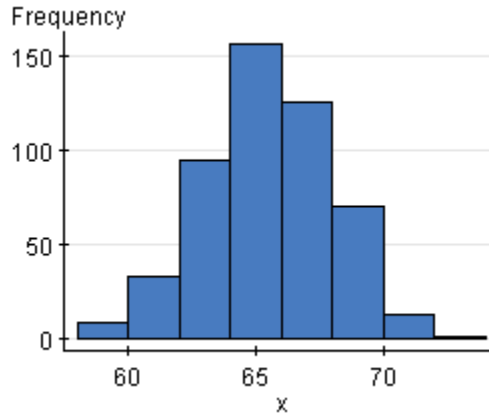
\_\_\_ Heights of randomly selected women aged 18 to 24.

\_\_\_ Student scores on an extremely difficult 10-problem statistics quiz.

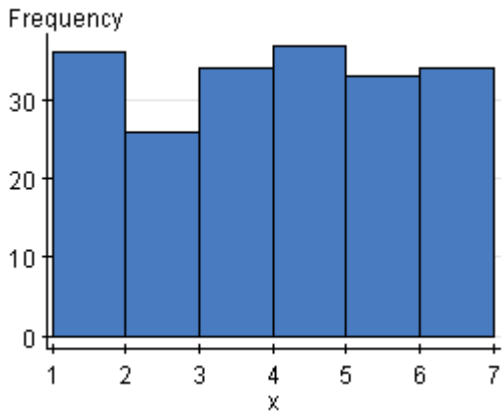
(A)



(B)



(C)



20) According to Harper's magazine, the time spent by kids in front of the television set per year can be modeled by a normal distribution with a mean equal to 1500 hours and a standard deviation equal to 250 hours. What percent of kids watch television for less than 1200 hours per year?

Name Key

Instructor \_\_\_\_\_

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**INSTRUCTIONS PART I:** Questions 1 - 10, Multiple choice. Answer all TEN questions and circle the correct answer.

- 1) A quiz consists of 190 true or false questions. If the student guesses on each question, what is the mean number of correct answers?

Chapter 6

- A) 0
- B) 190
- C) 95**
- D) 38

This is a Binomial probability problem

$$\mu_x = np \quad (\text{formula card})$$

$$= 190 (.5)$$

$$= 95$$

- 2) The principal at Riverside High School would like to estimate the mean length of time each day that it takes all the buses to arrive and unload the students. How large a sample is needed if the principal would like to assert with 99% confidence that the sample mean is off by, at most, 6 minutes. Assume  $\sigma = 10$  minutes.

Chapter 9

- A) 20
- B) 18
- C) 19**
- D) 21

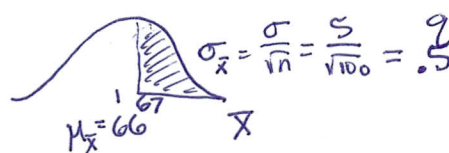
$$n = \left( \frac{Z_{\alpha/2} \cdot \sigma}{E} \right)^2 \quad (\text{formula card})$$

$$= \left( \frac{2.575 \cdot 10}{6} \right)^2 = 18.418 \quad \text{so we need } n = 19$$

- 3) The average score of all golfers for a particular course has a mean of 66 and a standard deviation of 5. Suppose 100 golfers played the course today. Find the probability that the average score of the 100 golfers exceeded 67.

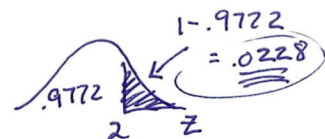
Chapter 8

- A) 0.0228**
- B) 0.3707
- C) 0.4772
- D) 0.1293



$$P(\bar{x} > 67) = P\left(z > \frac{67-66}{.5}\right)$$

$$= P(z > 2)$$



- 4) A survey of 100 fatal accidents showed that in 32 cases the driver at fault was inadequately insured. Find a point estimate for  $p$ , the population proportion of accidents where the driver at fault was inadequately insured.

chapter 9

- A) 0.32  
 B) 0.68  
 C) 0.471  
 D) 0.242

$$\hat{p} = \frac{x}{n} \quad (\text{formula card})$$

$$= \frac{32}{100} = 0.32$$

- 5) Suppose a particular outcome from a random event has a probability of 0.02. Which of the following statements represents the correct interpretation of this probability?

chapter 5

- A) The outcome will never happen.  
 B) The outcome will certainly happen two times out of every 100 trials.  
 C) The outcome could happen, or it couldn't, the chances of either result are the same.  
 D) The outcome is expected to happen about two times out of every 100 trials.

$$0.02 = \frac{2}{100}$$

- 6) If the level of significance is 0.05, and the P-value is 0.043, the decision would be to

chapter 10

- A) fail to reject  $H_0$ .  
 B) make no decision because the difference between the level of significance and the P-value is not statistically significant.  
 C) use a nonparametric test because normality of the data cannot be established when the results are close.  
 D) reject  $H_0$ .

Since the P-value is smaller than the significance level, we Reject  $H_0$ .

- 7) One of the items on a student survey for an introductory statistics course was "Rate your intelligence on a scale of 1 to 10." The distribution of this variable for the 100 women in the class is presented below. What is the probability of randomly selecting a woman from the class who has an intelligence rating that is LESS than seven?

chapter 5

Intelligence Rating	Count
5	12
6	24
7	38
8	23
9	2
10	1

- A)  $38 / 100 = 0.38$   
 B)  $(12 + 24) / 100 = 0.36$   
 C)  $(12 + 24 + 38) / 100 = 0.74$   
 D)  $(23 + 2 + 1) / 100 = 0.26$   
 E) None of the above.

$$P(x < 7) = P(x=5) + P(x=6)$$

$$= \left( \frac{12 + 24}{100} \right)$$

$$= 0.36$$



8) A researcher obtained a random sample of 100 smokers and a random sample of 100 nonsmokers. After interviewing all 200 participants in the study, the researcher compared the rate of depression among the smokers with the rate of depression among nonsmokers. Determine which type of study is described.

chapter 1

- A) observational study
- B) scientific distribution
- C) probability sample
- D) experiment

9) The data below are the final exam scores of 10 randomly selected history students and the number of hours they slept the night before the exam.

chapter 7

Find the equation of the regression line for the given data, reporting coefficients to the nearest hundredth. (use calculator/formula card)  $\hat{y} = 5.04x + 56.11$

What would be the predicted score for a history student who slept 7 hours the previous night? Round your answer to the nearest whole number.

$$5.04(7) + 56.11 = 91.39$$

so 91

Is this a reasonable question?

Hours, x	3	5	2	8	2	4	4	5	6	3
Scores, y	65	80	60	88	66	78	85	90	90	71

- A)  $\hat{y} = 5.04x + 56.11$ ; 91; Yes, it is reasonable. (within the scope of the observed data)
- B)  $\hat{y} = 5.04x + 56.11$ ; 91; No, it is not reasonable. 7 hours is well outside the scope of the model.
- C)  $\hat{y} = -5.04x + 56.11$ ; 21; No, it is not reasonable. 7 hours is well outside the scope of the model.
- D)  $\hat{y} = -5.04x + 56.11$ ; 21; Yes, it is reasonable.

10) To win at LOTTO in a certain state, one must correctly select 6 numbers from a collection of 50 numbers (one through 50.) The order in which the selections is made does not matter. How many different selections are possible?

chapter 5

- A) 13,983,816
- B) 300
- C) 720
- D) 15,890,700

This is a combinations problem.

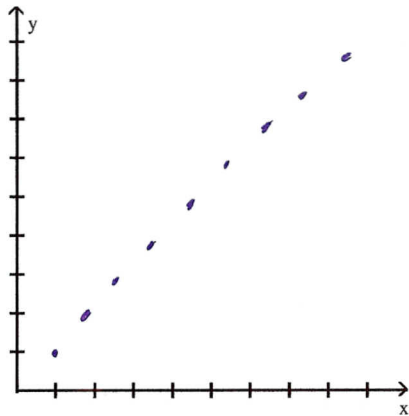
$${}^n C_r = \frac{n!}{r!(n-r)!} \quad (\text{formula card})$$

$${}_{50} C_6 = 15,890,700 \quad (\text{calculator})$$

**INSTRUCTIONS PART II:** Questions 11 - 20, Short Response. Answer all TEN questions, carefully and completely showing your work and clearly indicating your answer.

chapter 4

11) Draw a scatter diagram for which  $r = 1$ .



12) The Environmental Protection Agency (EPA) uses a measure called the Pollutant Standards Index (PSI) to measure air quality in a city. A PSI reading over 100 indicates a day when the air quality is considered unhealthy. The measurements represent the number of days in 1995 that the PSI was over 100 for twenty metropolitan areas in the U.S. Midwest.

min  $Q_1 = 1$  Median = 2.5  $Q_3 = 4.5$  max  
 (0), 0, 0, 1, 1, | 1, 1, 1, 2, 2, | 3, 4, 4, 4, 4, | 5, 7, 7, 11, (14)

chapter 2  
chapter 3

Determine the five-number summary for the data.

min = 0  $Q_1 = 1$  Median = 2.5  $Q_3 = 4.5$  max = 14

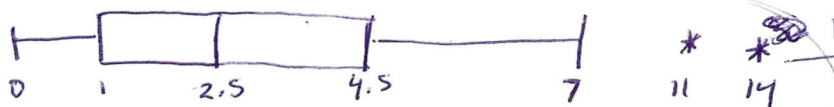
Construct a boxplot for the data (showing outliers if any). You must show all the calculations needed to determine if there are outliers. (formula card)

$$IQR = Q_3 - Q_1 = 4.5 - 1 = 3.5$$

$$\begin{aligned} \text{Lower fence} &= Q_1 - 1.5(IQR) \\ &= 1 - 1.5(3.5) = -4.25 \end{aligned}$$

$$\begin{aligned} \text{Upper fence} &= Q_3 + 1.5(IQR) \\ &= 4.5 + 1.5(3.5) = 9.75 \end{aligned}$$

Boxplot



\* \* 11 and 14 are outliers.

- 13) A local bank needs information concerning the savings account balances of its customers. A random sample of 16 accounts was checked. The mean balance was \$786.75 with a standard deviation of \$156.20. Find a 98% confidence interval for the true mean. Assume that the account balances are normally distributed. Report your confidence intervals rounded to the nearest cent. Chapter 9

Find the appropriate critical value for  $t_{\alpha/2}$  or  $z_{\alpha/2}$  and report it: 2.602

Compute the margin of error (show your work):

$$t_{\alpha/2} \frac{s}{\sqrt{n}} = 2.602 \cdot \frac{156.20}{\sqrt{16}} = 101.6081$$

Report the confidence interval:

$$\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$786.75 \pm 101.6081$$

$$(\$685.14, \$888.36)$$

(Formula card)

$$n = 16$$

$$\bar{x} = \$786.75$$

$$s = \$156.20$$

$$98\%$$

$$\alpha/2 = .01$$

$$t_{.01, 15} = 2.602$$

- 14) The following table records the number of movies released by each distributor in 2008 (from [www.the-numbers.com](http://www.the-numbers.com)). Chapter 3

DISTRIBUTER	MOVIES
Warner Bros.	31
Paramount Pictures	17
Sony Pictures	18
Universal	21
20th Century Fox	24
Buena Vista	19
Lionsgate	19
Fox Searchlight	9
Summit Entertainment	5
Focus Features	8

- (a) Determine the mean and median number of movies released by a distributor in 2008. Round your answers to the nearest tenth.

the mean is 17.1 movies released  
 the median is 18.5 movies released (formula card)

- (b) Determine the standard deviation and range of the number of movies released by a distributor in 2008. Round your answers to the nearest tenth.

the standard deviation is 7.5 movies released  
 the range is  $31 - 5 = 26$  movies released (formula card)



Test the given claim using the classical approach to hypothesis testing. Identify the null and alternative hypotheses, test statistic, critical value(s), conclusion about the null hypothesis, and final conclusion that addresses the original claim.

Chapter 10

- 15) A local juice manufacturer distributes juice in bottles labeled 32 ounces. A government agency thinks that the company is cheating its customers. The agency selects 35 of these bottles, measures their contents, and obtains a sample mean of 31.7 ounces with a standard deviation of 0.70 ounce. Use a 0.01 significance level to test the agency's claim that the company is cheating its customers.

Null Hypothesis:

$$H_0: \mu = 32 \text{ oz} \quad X$$

Alternative Hypothesis:

$$H_1: \mu < 32 \text{ oz} \quad \text{claim}$$

$$\begin{aligned} n &= 35 \\ \bar{x} &= 31.7 \\ s &= 0.70 \\ \alpha &= 0.01 \\ \text{claim: } \mu &< 32 \text{ oz} \end{aligned}$$

Test Statistic:

$$t_0 = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{31.7 - 32}{0.70/\sqrt{35}} = -2.535 \quad (\text{formula correct})$$

Critical Value(s):



Conclusion about the Null Hypothesis:

Since the test statistic of  $-2.535$  falls in the rejection region ( $t < -2.441$ ), we REJECT  $H_0$ .

Conclusion addressing the original claim:

The sample data support the agency's claim that the juice company is cheating its customers by under filling the bottles.

chapter 9

16) A university dean is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 118 of them are receiving financial aid. Use a 99% confidence interval to estimate the true proportion of students on financial aid. Round your result to the nearest hundredth.

Find the appropriate critical value for  $t_{\alpha/2}$  or  $z_{\alpha/2}$  and report it: 2.575

Compute the margin of error (show your work):

$$z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 2.575 \cdot \sqrt{\frac{0.59(1-0.59)}{200}} = 0.08955$$

Report the confidence interval:

$$\hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$0.59 \pm 0.08955$$

$$(0.50, 0.68)$$

(formula card)

$$\begin{aligned} n &= 200 \\ X &= 118 \\ \hat{p} &= 118/200 = 0.59 \end{aligned}$$

99%

$$\alpha/2 = 0.005$$

$$z_{.005} = 2.575$$

17) A human gene carries a certain disease from the mother to the child with a probability rate of 35%. That is, there is a 35% chance that the child becomes infected with the disease. Suppose a female carrier of the gene has five children. Assume that the infections of the five children are independent of one another. Find the probability that at least one of the children get the disease from their mother. Round your answer to the nearest thousandth.

chapter 5

P(at least one of 5 kids gets infected)

$$= 1 - P(\text{none of the 5 kids get infected})$$

$$= 1 - (0.65)^5$$

$$= 1 - 0.1160290625$$

$$= 0.884$$

$$\begin{aligned} P(\text{infected}) &= 0.35 \\ P(\text{not infected}) &= 1 - 0.35 \\ &= 0.65 \end{aligned}$$

multiplication rule for independent events (formula card)



Test the given claim using the P-value method of hypothesis testing. Identify the null and alternative hypotheses, test statistic, P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

18) A card company claims that 80% of all American college students send a card to their mother on Mother's Day. Suppose you plan to gather your own data to test this claim. You select a simple random sample of 150 American college students to determine the proportion of them who send a card to their mother on Mother's Day. Your sample indicates that 70% of the students sampled send a card to their mother on Mother's Day. Does this make you accept or reject the card companies claim? Carefully justify your answer using a 0.05 significance level.

Null Hypothesis:  $H_0: p = 0.80$  X claim

Alternative Hypothesis:  $H_1: p \neq 0.80$

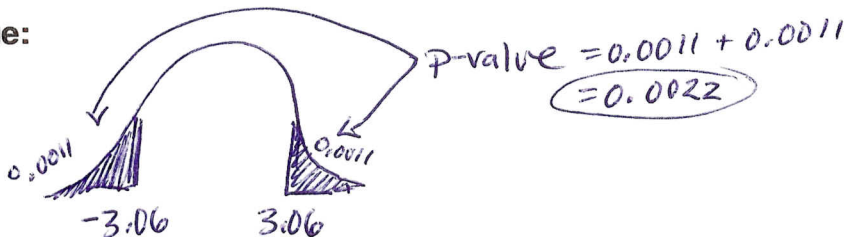
claim  $p = .80$   
 $n = 150$   
 $\hat{p} = 0.70$   
 $\alpha = 0.05$

Test Statistic:

$$Z_0 = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.70 - 0.80}{\sqrt{\frac{0.80(1-0.80)}{150}}} = -3.06$$

(formula card)

P-value:



Conclusion about the Null Hypothesis:

Since the p-value of 0.0022 is LESS than the significance level of  $\alpha = 0.05$ , we REJECT  $H_0$ .

Conclusion addressing the original claim:

The sample data do not support the card companies claim that 80% of all American college students send a card to their mother on Mother's Day.

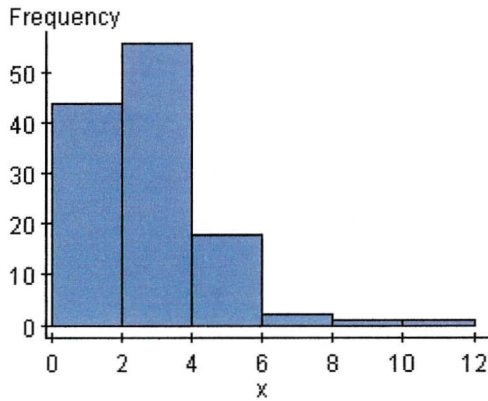
19) Choose the graph that best matches each variable described and write the letter in the blank.

C 200 rolls of a fair six-sided die. *appears uniform*

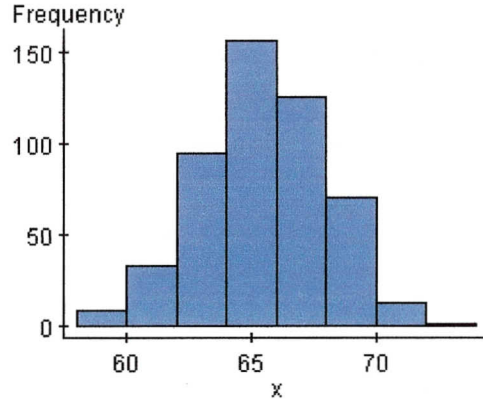
B Heights of randomly selected women aged 18 to 24. *appears normal*

A Student scores on an extremely difficult 10-problem statistics quiz. *appears right skewed*

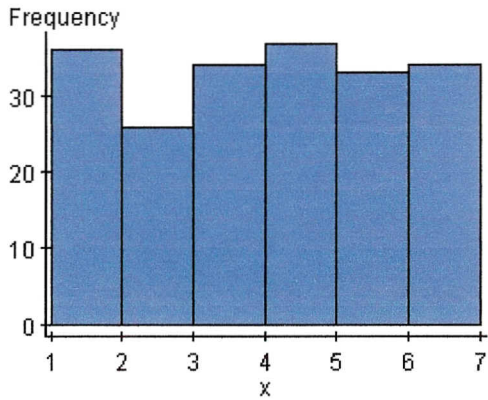
(A)



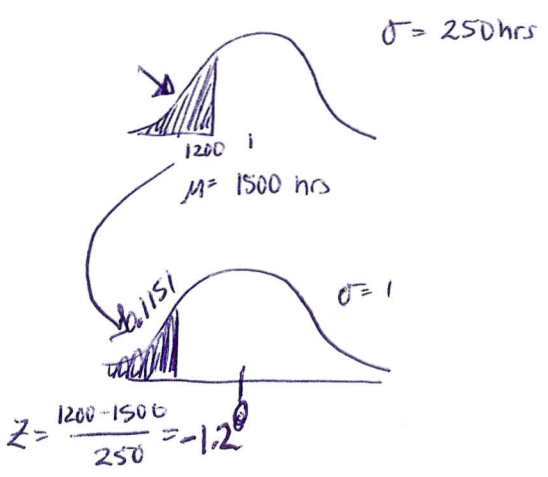
(B)



(C)



20) According to Harper's magazine, the time spent by kids in front of the television set per year can be modeled by a normal distribution with a mean equal to 1500 hours and a standard deviation equal to 250 hours. What percent of kids watch television for less than 1200 hours per year?



$$P(Z < -1.20) = 0.1151$$

11.51% of kids watch TV for less than 1200 hours per year.