

## Math 115 - Statistics

### Final Exam Review (Fall 2023)

**Multiple Choice:** Choose the best possible answer.

1. To conduct a study on depression among the elderly, all of the patients from four local nursing homes were used. There were 12 nursing homes in the area. Identify the type of sampling used.  

A. Stratified sampling	B. Simple Random sampling
C. Cluster sampling	D. Systematic sampling
  
2. Subscribers to a new smartphone app were assigned numbers. Then a sample of 50 subscribers were selected by using a random number generator. Those selected were asked to rate the ease of use of the app. Identify the type of sampling used.  

A. Stratified sampling	B. Simple Random sampling
C. Cluster sampling	D. Systematic sampling
  
3. Twenty-five students who use the college athletic facilities were asked if they would approve a facility fee increase in order to fund some new equipment for the weight room. Identify both the sample and the population groups.  

A.	Sample:	All students who use the athletic facilities
	Population:	The Twenty-five students who were selected
B.	Sample:	The Twenty-five students who were selected
	Population:	All students attending the college
C.	Sample:	The Twenty-five students who were selected
	Population:	All students who use the athletic facilities
D.	Sample:	The students who would approve a fee increase
	Population:	The Twenty-five students who were selected
  
4. A researcher took a random sample of adults and asked them about their bedtime routine. The researcher found that the adults who drank a cup of tea before bedtime were more likely to fall asleep earlier than those who did not drink any tea. What type of study is this?  

A. Experimental	B. Observational	C. Case-Control	D. Neither
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5. A tooth whitening gel is to be tested for effectiveness. A group of 100 adults volunteer to participate in the study. 50 volunteers are given a gel that contains a tooth whitening agent. The other 50 are given a gel that does not contain the tooth whitening agent. What type of study is this?
- A. Experimental      B. Observational      C. Case-Control      D. Neither
6. Blood type is an example of what type of data?
- A. Qualitative      B. Quantitative      C. Discrete      D. Ordinal
7. The number of employees at a local amusement park is an example of what type of data?
- A. Qualitative      B. Quantitative      C. Discrete      D. Both B and C
8. The heights of all fifth graders at an elementary school is an example of what type of data?
- A. Quantitative      B. Continuous      C. Discrete      D. Both A and B
9. The daily high temperature in degrees Fahrenheit in Kansas City for 30 consecutive days is an example of what type of data?
- A. Nominal      B. Ordinal      C. Interval      D. Ratio

**Use the following data set to answer questions #10 – #12.**

Certain kinds of tumors tend to recur. The following 42 data points represent the lengths of time (in months), for a tumor to recur after chemotherapy.

19	18	17	1	21	22	54	46	25	49	27
50	1	59	39	43	39	5	9	39	18	20
14	45	54	59	46	50	29	12	19	36	
38	40	43	41	10	50	41	25	19	39	

10. Construct a frequency distribution for the given quantitative data. Use a class width of 12.

A.

<u>Class</u>	<u>Frequency</u>
1 – 13	6
14 – 26	12
27 – 39	8
40 – 52	12
53 – 65	4

B.

<u>Class</u>	<u>Frequency</u>
1 – 12	6
13 – 24	10
25 – 36	5
37 – 48	13
49 – 60	8

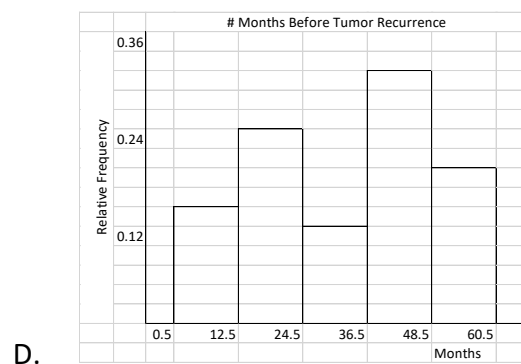
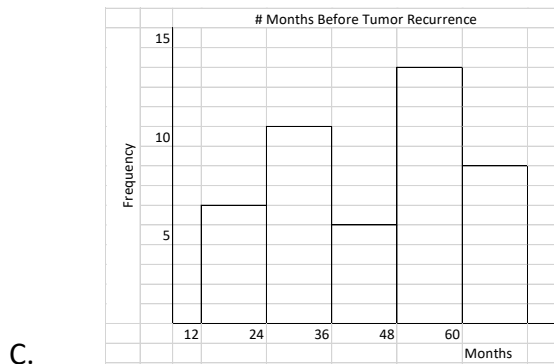
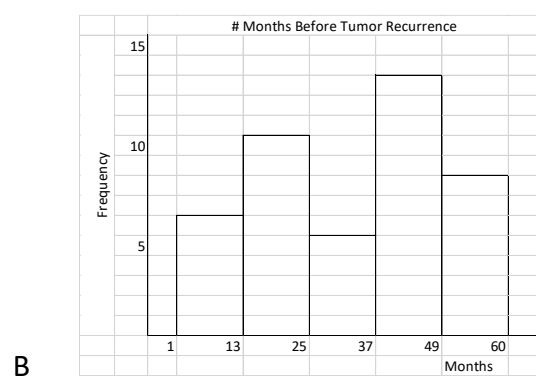
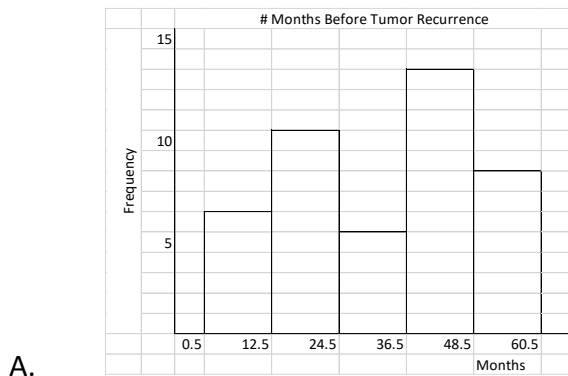
C.

<u>Class</u>	<u>Frequency</u>
1 – 13	6
14 – 26	10
27 – 39	5
40 – 52	13
53 – 65	8

D.

<u>Class</u>	<u>Frequency</u>
1 – 12	6
13 – 24	12
25 – 36	8
37 – 48	12
49 – 60	4

11. Construct a frequency histogram using the frequency distribution in problem #10.



12. Identify the overall shape of the distribution in problem #11.  
 A. Bell Shaped      B. Left Skewed      C. Right Skewed      D. Bi-Modal

**Use the following data set which contains the prices of 15 different ice cream bars to answer questions #13 - #15.**

\$0.80      \$1.29      \$1.09      \$0.99      \$0.75  
 \$1.25      \$1.09      \$0.69      \$0.80      \$1.05  
 \$1.09      \$1.15      \$0.80      \$0.89      \$1.19

13. Find the mean for the given data.  
 A. \$1.00      B. \$0.19      C. \$0.99      D. \$1.05
14. Find the median for the given data.  
 A. \$1.00      B. \$0.19      C. \$0.99      D. \$1.05
15. Find the mode for the given data.  
 A. \$0.80      B. \$1.09      C. No Mode      D. Both A and B
16. A random sample of the ages of 50 professional football players are summarized in the frequency distribution below. Find the mean of the grouped data. *Hint: Find the mid-point of each group.*

Ages of Professional Football Players	
Age	Number of Players
16 - 20	1
21 - 25	17
26 - 30	14
31 - 35	8
36 - 40	5
41 - 45	3
46 - 50	2

- A. 29.6      B. 27.6      C. 31.6      D. 25.1

17. A student wants to calculate their GPA for the most recent semester. A's are worth 4 GPA points, B's are worth 3 GPA points, C's are worth 2 GPA points, and D's are worth 1 GPA point. If the student took 15 credit hours and earned the following grades in their classes, find the student's weighted GPA (mean) for the semester.

Class	# Credits	Grade
US History	3	A
Biology	5	C
Algebra	4	B
English	3	A

- A. 3.75      B. 3.07      C. 3.25      D. 3.33

18. In 2019, the average cost of a movie ticket in the United States was \$9.16. Find the standard deviation for the sample of movie ticket prices given below.

\$10.00      \$9.25      \$8.75      \$10.25      \$9.50  
 \$8.50      \$9.00      \$8.00      \$9.00      \$9.35

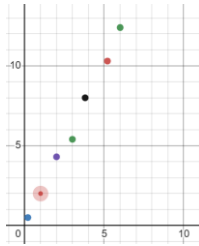
- A. \$0.63      B. \$0.40      C. \$0.67      D. \$0.45

19. The average number of points the Los Angeles Lakers have scored for the previous 20 basketball seasons is listed below. Calculate the five-number summary for the given data.

112      110      113      112      108  
 105      97      99      103      102  
 97      102      102      107      109  
 103      100      99      98      100

- A. Min = 97      B. Min = 97      C. Min = 97      D. Min = 97  
 Q1 = 99.5      Q1 = 99.5      Q1 = 102      Q1 = 101  
 Med = 103.9      Med = 102.5      Med = 103.5      Med = 105  
 Q3 = 108.5      Q3 = 108.5      Q3 = 108      Q3 = 109  
 Max = 113      Max = 113      Max = 113      Max = 113

20. What is the Interquartile range (IQR) of the previous data set?
- A. 16                      B. 8                      C. 5                      D. 9
21. Which type of chart describes wedges of a circle that visually display proportional parts of a total population that share a common characteristic?
- A. Pareto Chart      B. Pie Chart              C. Bar Chart              D. Time Series Chart
22. Which statements are true regarding the correlation coefficient,  $r$ , for a linear regression model?
- A.  $r$  is a unitless measurement between -1 and 1
- B. Positive values of  $r$  imply that as  $x$  increases,  $y$  increases, and negative values of  $r$  imply that as  $x$  increases,  $y$  decreases
- C. The closer  $r$  is to 1 or -1, the more closely the relationship between  $x$  and  $y$  depicts a linear model
- D. All of the above
23. Which correlation coefficient most likely represents the scatter plot shown below?



- A,  $r = 0.50$       B.  $r = -0.50$       C.  $r = 0.90$       D.  $r = -0.90$
24. The table below shows the per capita income (in thousands of dollars) and the number of medical doctors (per 10,000 residents) for 6 different cities in Oregon. Determine the correlation coefficient ( $r$ ).

Per Capita Income (\$1000's)	8.6	9.3	10.1	8.0	8.3	8.7
Number of medical doctors (per 10000 residents)	9.6	18.5	20.9	10.2	11.4	13.1

- A. -0.8718      B. -0.9337      C. 0.8718      D. 0.9337

25. For the upcoming semester, a college student plans to enroll in 1 math class, 1 science class, 1 English class, and 1 history class. If there are 3 math classes, 5 science classes, 4 English classes, and 2 history classes to choose from, how many different schedule options are possible?
- A. 120                      B. 14                      C. 24                      D. 30
26. So far this season, a baseball player has been up to bat 54 times. He has struck out 25 times, walked 13 times, singled 9 times, doubled 4 times, tripled one time, and hit 2 home runs. At his next at bat, what is the probability the player will strike out?
- A. 0.463                      B. 0.500                      C. 0.581                      D. 0.250
27. A player is dealt 4 cards from a standard deck. What is the probability that all four cards will be Aces?
- A. 0.000035                      B. 0.0000037                      C. 0.036228                      D. 0.0000033
28. A bag contains 400 colored marbles – 100 each of blue, green, red, and yellow. Someone pulls two marbles out of the bag (without replacement). Let A be the event that the first marble is blue. Let B be the event that the second marble is blue. What is the probability of A and B both happening?
- A. 0.0625                      B. 0.4980                      C. 0.1240                      D. 0.0620
29. A high school debate team consists of 10 juniors and 15 seniors. Five members are chosen to compete in the state tournament. What is the probability that the state team consists of 2 juniors and 3 seniors?
- A. 0.0094                      B. 0.3854                      C. 0.2000                      D. 0.0385

30. Data was gathered from 46,687 individuals to determine whether they had defaulted on a loan or not. The participants were classified by age group and whether or not they have ever defaulted on a loan. If a person is chosen at random, what are the chances that the individual is middle aged and has defaulted on a loan?

	Young	Middle-Aged	Senior Citizens	Total
Defaulted	3586	4851	120	8557
Not Defaulted	10503	27368	259	38130
Total	14089	32219	379	46687

- A. 0.151      B. 0.769      C. 0.104      D. 0.873
31. Out of 100 customers in a restaurant, 65 ordered an appetizer, 30 ordered a dessert, and 20 ordered both an appetizer AND a dessert. What is the probability that a customer orders an appetizer OR a dessert?
- A. 0.95      B. 0.65      C. 0.75      D. 0.85
32. A sixty-year old healthy male spends \$2000 annually on a \$50,000 life insurance policy. The probability that he will live through the year is 0.9881. From the perspective of the life insurance company, what is the **expected value** of the policy? (*Hint: Consider the definitions of Expected Value vs. Expected Cost*)
- A. \$1976.20      B. \$595      C. \$1381.20      D. -1381.20
33. A research team at Cornell University conducted a study showing that approximately 10% of all businessmen who wear ties wear them so tightly that they actually reduce blood flow to the brain. At a board meeting of 20 businessmen, all of whom are wearing ties, what is the probability that three or more ties are too tight?  $P(\geq 3)$
- A. 0.1901      B. 0.6769      C. 0.1330      D. 0.3231

**Use the following information to answer questions #34 and #35.**

About 25% of those called, will find an excuse to get out of jury duty (work, health, travel, etc). If 20 people are called for jury duty .....

34. For the binomial distribution above, find the mean number of individuals who avoid jury duty.
- A. 5      B. 500      C. 22.4      D. 2.24



35. For the binomial distribution, find the standard deviation of the number of individuals who avoid jury duty.
- A. 3.75      B. 1.94      C. 2.24      D. 194
36. Scores on the standardized ACT test and standardized SAT test are normally distributed. The average ACT score is a 21 with a standard deviation of 6. The average SAT score is a 1050 with a standard deviation of 200. If a student scores a 26 on the ACT and a 1200 on the SAT, on which exam did the student earn a better score?
- A. ACT      B. SAT      C. The same      D. Not enough info
37. Find the area under the standard normal curve that is between the interval of  $z = -1.8$  and  $z = 2.4$ .
- A. 0.6000      B. 0.5250      C. 0.9559      D. 0.0441
38. Police response time to an emergency call is the difference between when the call is first received by the dispatcher and the time a patrol car radios that it has arrived at the scene. Over a long period of time, it has been determined that the police response time has a normal distribution with a mean of 8.4 minutes and a standard deviation of 1.7 minutes. For a randomly received call, what is the probability that the response time will be between 5 and 10 minutes?
- A. 0.8039      B. 0.8216      C. 0.1930      D. 0.2040
39. The Denver Post stated that 80% of all new products introduced into grocery stores fail (are taken off the market) within 2 years. If a grocery store chain introduces 66 new products, what is the probability that 47 or more will fail within 2 years? (*Hint: Use the Normal Approximation to the Binomial*).
- A. 1.000      B. 0.9627      C. 0.8902      D. 0.9737
40. The population standard deviation in the price of a watermelon is known to be \$1.92. Find the sample size necessary to ensure that 90 times out of 100, the maximum margin of error for the mean price of a watermelon is  $E = 0.3$ .
- A. 110      B. 8      C. 11      D. 111

41. Tetany (severe muscle spasms) is associated with patients who have an average total calcium level below 6 mg/dl. The calcium levels for 10 adult patients are listed below. Find a 95% confidence interval for the population mean of total calcium in the blood of adults.
- 9.3    8.8    10.1    8.9    9.4    9.8    10.0    9.9    11.2    12.1
- A. (9.318, 10.582)    B. (9.220, 10.680)    C. (9.039, 10.861)    D. (8.901, 10.999)
42. Which statement(s) below are true regarding the types of errors in hypothesis testing?
- i. A Type I error occurs when the null hypothesis is rejected, but it should not have been.
  - ii. A Type II error occurs when the null hypothesis is rejected, but it should not have been.
  - iii. A Type I error occurs when the null hypothesis is not rejected, but it should have been.
  - iv. A Type II error occurs when the null hypothesis is not rejected, but it should have been.
- A. i                      B. iv                      C. i and iv              D. ii and iii
43. For a regular two-tailed test with  $\alpha = 0.05$ , the boundaries for the critical region would be defined by the following z-scores -
- A.  $z = \pm 1.96$     B.  $z = \pm 2.58$     C.  $z = \pm 2.33$     D.  $z = \pm 1.645$
44. In a repeated measures study comparing two treatments, if a one-tailed test with  $\alpha = 0.01$  and a sample size of  $n = 25$  is conducted, the boundaries for the critical region would be defined for the "t-statistic" as -
- A.  $t = 2.797$     B.  $t = 2.787$     C.  $t = 2.492$     D.  $t = 2.485$
45. Which of the following statements are true about hypothesis testing with one set of data?
- i. Standard error is the amount of difference between the sample mean and  $\mu$  that is reasonable to expect if  $H_0$  is true
  - ii. If the x distribution is normal or  $n \geq 30$ , with known population standard deviation, use the standard normal ("z")
  - iii. If the x distribution is normal or  $n \geq 30$ , with unknown population standard deviation, use the Student's "t" distribution.
- A. i                      B. ii                      C. iii                      D. All of the above

46. In a large survey of countries, it was found that approximately 24% of the population prefers the color blue. In a random sample of 56 college students, 12 indicated that they prefer blue. Does this information support a claim that the color preference of college students is different than the color preference of the general population? Identify the correct null and alternate hypothesis that would be used to test this claim.
- A.  $H_0: p = 0.24$  ;  $H_1: p \neq 0.24$       B.  $H_0: p = 0.24$  ;  $H_1: p < 0.24$   
C.  $H_0: p = 24$  ;  $H_1: p \neq 24$       D.  $H_0: \mu = 0.24$  ;  $H_1: \mu \neq 0.24$
47. A researcher conducts a repeated-measures study comparing two treatments. 50 people participate in the study and the researcher computes a test statistic of 2.38. At the  $\alpha = 0.05$  level, what is the correct decision for a two-tailed test? Will this decision change if the significance level is changed to  $\alpha = 0.01$ ?
- A. Reject the null at  $\alpha = 0.05$ . Keep the decision the same if  $\alpha = 0.01$ .  
B. Reject the null at  $\alpha = 0.05$ . Change the decision to Do Not Reject if  $\alpha = 0.01$ .  
C. Do Not Reject the null at  $\alpha = 0.05$ . Keep the decision the same if  $\alpha = 0.01$ .  
D. Do Not Reject the null at  $\alpha = 0.05$ . Change the decision to Reject if  $\alpha = 0.01$ .

**Use the following information to answer questions #48 and #49.**

Pyramid Lake is on the Paiute Indian Reservation in Nevada. The lake is famous for cutthroat trout. It has been widely advertised that the average length of trout caught in Pyramid Lake is  $\mu = 19$  inches. In a recent sample, however, of a random sample of 55 fish caught from the lake, the mean length was  $\bar{x} = 18.5$  inches with a standard deviation of  $s = 3.2$  inches. Can it be claimed that the average length of a trout caught from Pyramid Lake is less than 19 inches? Use a significance level of  $\alpha = 0.01$ .

48. State the Null and Alternate Hypothesis
- A.  $H_0: \mu = 19$  ;  $H_1: \mu \neq 19$       B.  $H_0: \mu = 19$  ;  $H_1: \mu < 19$   
C.  $H_0: \mu = 19$  ;  $H_1: \mu > 19$       D.  $H_0: p = 19$  ;  $H_1: p < 19$

49. Will you conclude to Reject OR Do Not Reject the null Hypothesis? Are the data statistically significant at the given level for  $\alpha$  ?
- A. At the  $\alpha = 0.01$  level, we Reject the null hypothesis and conclude the data are statistically significant.
  - B. At the  $\alpha = 0.01$  level, we Do Not Reject the null hypothesis and conclude the data are statistically significant.
  - C. At the  $\alpha = 0.01$  level, we Reject the null hypothesis and conclude the data are not statistically significant.
  - D. At the  $\alpha = 0.01$  level, we Do Not Reject the null hypothesis and conclude the data are not statistically significant.
50. A recent health study conducted in the state of Kansas claimed that there is a lower rate of hay fever in individuals over 50 years of age vs. those who are under 25 years of age. Assume the rate of hay fever in both age groups is normally distributed. The following information is available:
- Individuals over 50 years:  $\bar{x}_1 = 99.36, s_1 = 11.57, n_1 = 14$
- Individuals under 25 years:  $\bar{x}_2 = 109.5, s_2 = 15.41, n_2 = 16$

Is the rate of hay fever in those over 50 years old lower than those under 25 years old? Use  $\alpha = 0.05$ . Find the test statistic and the p value for this claim.

- |                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|
| A. $t = -2.052$ | B. $t = -2.052$ | C. $t = -2.052$ | D. $z = -2.052$ |
| $p = 0.9751$    | $p = 0.0497$    | $p = 0.0249$    | $p = 0.0201$    |

# Math 115 Short Answer Final Assessment Review Questions

## Question #1

A restaurant wants to ensure quality standards, so it requires hamburger patties to weigh a specific amount. It has a policy to destroy hamburger patties that are more than 3 standard deviations from the mean. The hamburger patties should have a mean weight of 4 oz with a standard deviation of 0.3 oz. For what weights will the patties be destroyed?

Select the correct choice below and fill in the answer to complete your choice.  
(Round to one decimal place as needed.)

- A. \_\_\_\_\_  
A patty will be destroyed if the weight is less than \_\_\_\_\_ oz.
- B. \_\_\_\_\_  
A patty will be destroyed if the weight is between \_\_\_\_\_ oz and \_\_\_\_\_ oz.
- C. \_\_\_\_\_  
A patty will be destroyed if the weight is less than \_\_\_\_\_ oz or greater than \_\_\_\_\_ oz.
- D. \_\_\_\_\_  
A patty will be destroyed if the weight is greater than \_\_\_\_\_ oz.

## Question #2

In Independence, the average college student drinks 4.5 energy drinks per week with a standard deviation of 0.89 drinks. The average high school student drinks 5.2 energy drinks per week with a standard deviation of 1.5 drinks. Who drinks relatively more energy drinks per week: a college student who drinks 5.1 drinks or a high school student who drinks 5.4 drinks?

Find the corresponding z-scores. Select the correct choice below and fill in the answers to complete your choice.

- A. \_\_\_\_\_  
The z-score for the college student, \_\_\_\_\_, is smaller than the z-score for the high school student, \_\_\_\_\_, so the college student has relatively more drinks.
- B. \_\_\_\_\_  
The z-score for the college student, \_\_\_\_\_, is larger than the z-score for the high school student, \_\_\_\_\_, so the college student has relatively more drinks.
- C. \_\_\_\_\_  
The z-score for the high school student, \_\_\_\_\_, is smaller than the z-score for the college student, \_\_\_\_\_, so high school student has relatively more drinks.
- D. \_\_\_\_\_  
The z-score for the high school student, \_\_\_\_\_, is larger than the z-score for the college student, \_\_\_\_\_, so high school student has relatively more drinks.

### Question #3

The following data represent the amount of money earned on a game. In this game, a person flips a coin 3 times and earns \$1 for every face up heads.

<b>x (\$ earned)</b>	0	1	2	3
<b>Frequency</b>	10	24	19	7

Complete parts (A) and (B) below.

#### Part A

Construct a discrete probability distribution for the random variable  $x$ .

(Round to four decimal places as needed.)

<b>x (\$ earned)</b>	<b>P(x)</b>
0	
1	
2	
3	

#### Part B

Compute and interpret the mean of the random variable  $x$ .

$\mu_x =$  \_\_\_\_\_ (Round to four decimal places as needed.)

Interpret the mean of the random variable  $x$ . Select one of the following:

- A. \_\_\_\_\_  
The game, if played many times, would be expected to earn about 1.5 dollars, on average.
- B. \_\_\_\_\_  
The game, if played one time, would be expected to earn about 1.4 dollars.
- C. \_\_\_\_\_  
The game, if played many times, would be expected to earn about 1.4 dollars, on average.

## ANSWER Key

- |       |       |
|-------|-------|
| 1. C  | 26. A |
| 2. B  | 27. B |
| 3. C  | 28. D |
| 4. B  | 29. B |
| 5. A  | 30. C |
| 6. A  | 31. C |
| 7. D  | 32. C |
| 8. D  | 33. D |
| 9. C  | 34. A |
| 10. B | 35. B |
| 11. A | 36. A |
| 12. D | 37. C |
| 13. C | 38. A |
| 14. D | 39. D |
| 15. D | 40. D |
| 16. A | 41. B |
| 17. B | 42. C |
| 18. C | 43. A |
| 19. B | 44. C |
| 20. D | 45. D |
| 21. B | 46. A |
| 22. D | 47. B |
| 23. C | 48. B |
| 24. D | 49. D |
| 25. A | 50. C |

Short answer key:

#1) C) A patty will be destroyed if the weight is less than 3.1 oz or greater than 4.9 oz.

#2) B) The z-score for the college student, .67, is larger than the z-score for the high school student, 1.3, so the college student has relatively more drinks.

#3) A)

X	P(x)
0	0.1667
1	0.4000
2	0.3167
3	0.1167

B)  $\mu = 1.3834$ , C) The game, if played many times, would be expected to earn about 1.4 dollars, on average.