

ACTM – Statistics Regional Exam March 5, 2016

For Questions 1 through 25 record your answer on the answer sheet provided. Be sure to use a pencil to mark your answers. After completing the multiple choice section, go to the constructed response items. These are used as tie breaker items only and do not count in the overall student score. Students should answer the constructed response items in numerical order. Be sure that your name is on each sheet.

1. The mean salary for college students is \$45,000. Is this value a statistic or a parameter?
 - a. The value is a statistic because it is a numerical measurement describing some characteristic of a population.
 - b. The value is a parameter because it is a numerical measurement describing some characteristic of a sample.
 - c. The value is a parameter because it is a numerical measurement describing some characteristic of a population.
 - d. The value is a statistic because it is a numerical measurement describing some characteristic of a sample.

2. A town obtains current employment data by polling 10,000 of its citizens this month. Identify the type of observational study.
 - a. Cross-sectional
 - b. Prospective
 - c. Retrospective
 - d. None of these

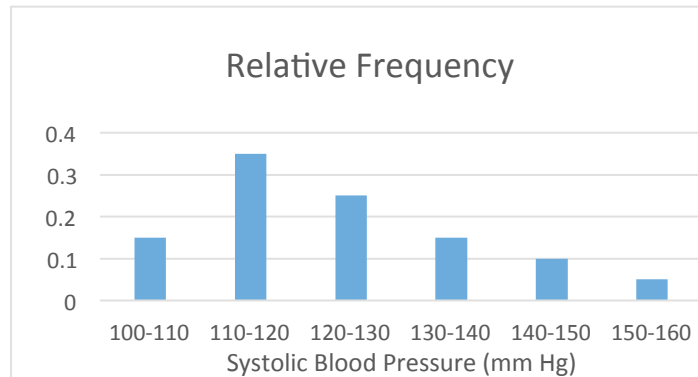
3. The frequency distribution below summarizes the home sale prices in the city of Summerhill for the month of June. Determine the width of each class.

Sales price in thousand \$	Frequency
80.0-110.9	2
111.0-141.9	5
142.0-172.9	7
173.0-203.9	10
204.0-234.9	3
235.0-265.9	1

- a. 30
- b. 28
- c. 61
- d. 31

4. A nurse measured the blood pressure of each person who visited her clinic. Below is a relative-frequency bar graph for the systolic blood pressure readings for those people aged between 25 and 40. The blood pressure readings were given to the nearest whole number. Identify the center of the third class.

- a. 130
- b. 124
- c. 120
- d. 125



5. The manager of a bank recorded the amount of time each customer spent waiting in line during peak business hours one Monday. The frequency distribution below summarizes the results. Estimate the mean waiting time. Round to one decimal place.

Waiting Time (in minutes)	Number of customers
0-3	9
4-7	9
8-11	13
12-15	6
16-19	6
20-23	1
24-27	2

- a. 6.6 minutes
- b. 9.9 minutes
- c. 9.7 minutes
- d. 45 minutes

6. Michael gets test grades of 71, 76, 80, and 86. He gets a 90 on his final exam. Find the weighted mean if the tests each count for 10% and the final exam counts for 60% of the final grade. Round to one decimal place.

- a. 85.3
- b. -71.2
- c. 241.8
- d. 80.6

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7. The ages of the members of a gym have a mean of 46 years and a standard deviation of 12 years. What can you conclude from Chebyshev's theorem about the percentage of gym members aged between 14.8 and 77.2?

- a. The percentage is at most 85.2%
- b. The percentage is at least 85.2%
- c. The percentage is at least 61.5%
- d. The percentage is approximately 61.5%

8. Mario's weekly poker winnings have a mean of \$301 and a standard deviation of \$60. Last week he won \$182. How many standard deviations from the mean is that?

- a. 0.99 standard deviations below the mean
- b. 1.98 standard deviations below the mean
- c. 1.98 standard deviations above the mean
- d. 0.99 standard deviations above the mean

9. The table summarizes the results of testing for a certain disease. If one of the results is randomly selected, what is the probability that it is a false negative (test indicates the person does not have the disease when in fact they do)? What does the probability suggest about the test?

	Positive Test Result	Negative Test Result
Subject has the disease	115	5
Subject does not have the disease	11	180

- a. 0.595; The probability of this error is high so the test is not very accurate.
- b. 0.035; The probability of this error is low so the test is fairly accurate.
- c. 0.016; The probability of this error is low so the test is fairly accurate.
- d. 0.042; The probability of this error is low so the test is fairly accurate.

10. Find the probability that four randomly selected people all have different birthdays. Assume only 365 possible birthdays.

- a. 0.9891
- b. 0.9918
- c. 0.9729
- d. 0.9836

11. In a batch of 8,000 clock radios, 5% are defective. A sample of 15 clock radios is randomly selected without replacement from the 8,000 and tested. The entire batch will be rejected if at least one of those tested is defective. Find the probability that the entire batch will be rejected.

- a. 0.537
- b. 0.050
- c. 0.067
- d. 0.463

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12. Eight basketball players are to be selected to play in a special game. The players will be selected from a list of 27 players. If the players are selected randomly, what is the probability that the eight tallest players will be selected?

- a. $1/2,220,075$
- b. $1/40,320$
- c. $1/213,127,200$
- d. $8/27$

13. Refer to the table, which summarizes the results of a sample. A subject is randomly selected, what is the probability the subject has brown hair given that they have blue eyes?

	Green Eyes	Blue Eyes
Brown Hair	82	7
Blond Hair	26	308

- a. 0.079
- b. 0.978
- c. 0.022
- d. 0.210

14. An archer is able to hit the bull's eye 57% of the time. If she shoots eight arrows, what is the probability that she gets exactly four bull's-eyes? Assume each shot is independent of the others.

- a. 0.152
- b. 0.106
- c. 0.253
- d. 0.004

15. The incomes of trainees at a local mill are normally distributed with a mean of \$1,100 and a standard deviation of \$150. What percentage of trainees earn less than \$900 a month?

- a. 40.82%
- b. 90.82%
- c. 35.31%
- d. 9.12%

16. Suppose that the IQ scores of adults are normally distributed with a mean of 100 and a standard deviation of 15. Find the IQ score that would be the cut off score for having an IQ in the top 10% of the population.

- a. 100.5
- b. 119.2
- c. 108.1
- d. 80.8

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17. In a population of 150 women, the heights of the women are normally distributed with a mean of 64.1 inches and a standard deviation of 3.10 inches. If 49 women are selected at random, find the mean and standard deviation of the population of sample means. Assume that the sampling is done without replacement and use a finite population correction factor.

- a. 64.1 inches, 3.10 inches
- b. 64.1 inches, 2.26 inches
- c. 64.1 inches, 0.36 inches
- d. 52.8 inches, 2.55 inches

18. A newspaper article about the results of a poll states: "In theory, the results of such a poll, in 99 cases out of 100 should differ by no more than 3 percentage points in each direction from what would have been obtained by interviewing all voters in the United States." Find the sample size suggested by this statement.

- a. 1,068
- b. 1843
- c. 1509
- d. 74

19. A survey of 300 union members in New York State reveals that 112 favor the Republican candidate for governor. Construct a 98% confidence interval for the true population proportion p of all New York State union members who favor the Republican candidate. Use the normal approximation method.

- a. $0.304 < p < 0.442$
- b. $0.316 < p < 0.430$
- c. $0.308 < p < 0.438$
- d. None of these

20. A group of 67 randomly selected students have a mean score of 21.9 on a placement test. The population standard deviation is $\sigma = 5$. What is the 90% confidence interval for the mean score μ of all students taking the test?

- a. $20.5 < \mu < 23.3$
- b. $20.3 < \mu < 23.5$
- c. $20.7 < \mu < 23.1$
- d. $20.9 < \mu < 22.9$

21. Find the p-value for a two-tailed test of means with $n=29$ and a test statistic $t=2.743$.

- a. 0.0105
- b. 0.0210
- c. 0.0053
- d. None of these

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22. The accuracy of verbal responses is tested in an experiment in which individuals report their heights and then are measured. The data consist of the reported height and measured height for each individual. What type of sample is this?

- a. Independent sample
- b. Dependent sample
- c. Codependent sample
- d. Cluster sample

23. The paired data below consist of the temperatures on randomly chosen days and the amount a certain kind of plant grew (in millimeters). Find the value of the linear correlation coefficient r .

Temp.	62	76	50	51	71	46	51	44	79
Growth	36	39	50	13	33	33	17	6	16

- a. -0.210
- b. 0
- c. 0.196
- d. 0.256

24. Six pairs of data yield $r=0.444$ and the regression equation $\hat{y} = 5x + 2$. Also, $\bar{y} = 18.3$. What is the best predicted value of y for $x=5$? Use a significance level of 0.05 and reference the table of critical r values for testing $H_0: \rho = 0$.

Sample size n	Critical r values for $\alpha=0.05$
4	0.950
5	0.878
6	0.811
7	0.754

- a. 93.5
- b. 4.22
- c. 18.3
- d. 27

25. Complete the sentence. The time it takes for the bus to arrive at the bus stop is _____.

- a. a discrete random variable.
- b. a continuous random variable.
- c. not a random variable.
- d. a random variable, but it is not discrete or continuous.

Name : _____

TIE BREAKERS

1. Fourteen people whose teeth were thoroughly cleaned and polished were randomly assigned to two groups of seven subjects each. Both groups were assigned to use oral rinses (no brushing) for a 2-week period. Group 1 used a rinse that contained an antiplaque agent. Group 2, the control group, received a similar rinse except that, unknown to the subjects, the rinse contained no antiplaque agent. A plaque index x , a measure of plaque buildup, was recorded at 4, 7 and 14 days. The mean and standard deviation for the 14 day plaque measurements are shown in the table for the two groups.

	Control	Antiplaque Group
Sample Size	7	7
Mean	1.26	0.78
Standard Deviation	0.32	0.32

- a. State the null and alternative hypotheses that should be used to test the effectiveness of the antiplaque oral rinse.

- b. Do the data provide evidence to indicate that the oral antiplaque rinse is effective? Test using $\alpha = 0.05$.

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Name : _____

2. Suppose you wish to compare the means of four populations based on independent random samples, each of which contains six observations.

A. Complete the ANOVA table below.

Source	df	SS	MS	F
Treatments		339.8		
Error				-
Total		473.2	-	-

- B. How many degrees of freedom are associated with the F statistic for testing $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$?

- C. Do the data provide sufficient evidence to indicate differences among the population means? (Use $\alpha = 0.05$.)

3. Previous geological studies indicate that exploratory oil wells drilled in the Fayetteville shale region have a 40% chance of striking oil. Assume the wells being drilled are independent of one another. Let X be the number of wells drilled up to and including the well where striking oil first occurs. Using this information, answer the questions below.

- A. What is the probability function for X? (Specify the distribution and the range of possible values of X.)

- B. What is the probability of striking oil for the first time after the second well is drilled?

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ACTM Statistics Exam Solutions

1. C
2. A
3. D
4. D
5. C
6. A
7. B
8. B
9. C
10. D
11. A
12. A
13. C
14. C
15. D
16. B
17. C
18. B
19. C
20. D
21. A
22. B
23. C
24. C
25. B

Tie Breakers

1. a. If the antiplaque rinse is effective, the plaque buildup should be less for the group using the rinse. Thus $H_0: \mu_1 - \mu_2 = 0$, $H_1: \mu_1 - \mu_2 > 0$ Where 1 is from the control group and 2 is from the antiplaque group.
 b. Test Statistic: $t = 2.806$
 Critical Value: $t_\alpha = 1.782$ (Reject H_0)
 p-value=0.0079
 Reject H_0 . There is evidence to indicate the rinse is effective.

2. a.

Source	df	SS	MS	F
Treatments	<u>3</u>	339.8	<u>113.2667</u>	<u>16.981</u>
Error	<u>20</u>	<u>133.4</u>	<u>6.67</u>	
Total	<u>23</u>	473.2		

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b. The degrees of freedom for this test are $df_1 = 3$ and $df_2 = 20$.

c. The rejection region for this test is $F_{TS} > 3.10$. Yes, The test statistic, 16.981 falls in the rejection region so reject H_0 . There is evidence to conclude there are differences in the population means.

3. a. $P(X=x)=f(x)=0.4(0.6)^{x-1}$ for $x \geq 1$.

B. $P(X>2)=1-P(X \leq 2)=1-[f(1)+f(2)]=1-[0.4+0.4*0.6]=0.36$ or 36% chance