

2002 National Mu Alpha Theta Convention
OPEN DIVISION
STATISTICS TOPIC TEST

Directions: The questions or incomplete statements that follow are each followed by five suggested answers or completions. Choose the response that best answers the question or completes the statement.

1. If a normal distribution has mean 200 and standard deviation 20, find K so that the probability that a sample value is less than K is .975.

- (A) 239
- (B) 204
- (C) 250
- (D) 215
- (E) NOTA

2. Increasing the frequencies in the tails of a distribution will:

- (A) not affect the standard deviation as long as the increases are balanced on each side of the mean
- (B) not affect the standard deviation.
- (C) increase the standard deviation.
- (D) reduce the standard deviation.
- (E) NOTA

3. Suppose that the regression line for a set of data, $\hat{y} = mx + 3$, passes through the point (2,7). If \bar{x} and \bar{y} are the sample means of the x - and y - values, respectively, find \bar{y} .

- (A) \bar{x}
- (B) $\bar{x} - 2$
- (C) $\bar{x} + 3$
- (D) $2\bar{x} + 3$
- (E) NOTA

4. The longevity of people living in a certain locality has a standard deviation of 14 years. What is the mean longevity if 30% of the people live longer than 75 years? Assume a normal distribution of life spans.

- (A) 61.00
- (B) 67.65
- (C) 74.48
- (D) The mean cannot be computed from the information given.
- (E) NOTA

5. In addition to control by comparing several treatments, the TWO other basic principles which distinguish experiments from observational studies include:

- I) randomization, i.e. assigning researchers by chance
- II) randomization i.e. assigning subjects by chance
- III) replication, i.e. doing a study more than once
- IV) replication, i.e. doing a study with many subjects
- V) blocking to remove bias

- (A) I and III
- (B) I and IV
- (C) II and III
- (D) II and IV
- (E) NOTA

6. A set of test scores had a mean of 89 and a standard deviation of 8. An unnamed AP Statistics teacher decides they are entirely too high, so he/she decides the set of scores should have a mean of 78 with a standard deviation of 12. Monica's score of 81 will become:

- (A) 58
- (B) 63
- (C) 66
- (D) 70
- (E) NOTA

7. A guidance counselor administers a vocabulary test to a random sample of high school seniors. Among 40 female students the average score is 69 with a standard deviation of 5.3, while among 48 male students the average score is 64 with a standard deviation of 5.6. What is a 90% confidence interval estimate for the difference in scores between female and male students?

- (A) 5 ± 1.16
- (B) 5 ± 1.36
- (C) 5 ± 1.92
- (D) 5 ± 2.23
- (E) NOTA

8. An engineer wishes to determine the quantity of heat being generated by a particular electronic component. If she knows that the standard deviation is 2.4, how many of these components should she consider to be 99% sure of knowing the answer to within ± 0.6 ?

- (A) 27
- (B) 87
- (C) 107
- (D) 212
- (E) NOTA

9. Two possible wordings for a questionnaire on a proposed school budget increase are as follows:

- I. This school district has one of the highest per student expenditure rates in the state. This has resulted in low failure rates, high standardized test scores, and most students going on to good colleges and universities. Do you support the proposed school budget increase?
- II. This school district has one of the highest per student expenditure rates in the state. This has resulted in high property taxes, with many people on fixed incomes having to give up their homes because they cannot pay the school tax. Do you support the proposed school budget increase?

One of these questions showed that 58% of the population favor the proposed school budget increase, while the other question showed that only 13% of the population support the proposed increase. Which produced which result and why?

- (A) The first showed 58% and the second 13% because of the lack of randomization as evidence by the wording of the question.
- (B) The first showed 13% and the second 58% because of a placebo effect due to the wording of the question.
- (C) The first showed 58% and the second 13% because of the lack of a control group.
- (D) The first showed 13% and the second 58% because of response bias due to the wording of the question.
- (E) NOTA

10. After a logarithmic transformation was done on the response variable for a bivariate relationship, the regression had an equation of $\log y = 0.19x + 0.839$. Find the value of y when $x = 2$.

- (A) 1.22
- (B) 15.73
- (C) 16.56
- (D) 17.83
- (E) NOTA

11. In a corporation, 30% of the employees contributed to a retirement program offered by the company. Find the probability that of 300 randomly selected people, at least 105 enrolled in the program.

- (A) .965
- (B) .035
- (C) .1029
- (D) .8971
- (F) NOTA

For questions 12 and 13 consider the following: Two random samples of students are chosen, one from those taking an AP Statistics class and one from those not. The following back-to-back stemplots compare the GPAs.

AP Statistics		No AP Statistics
	1	89
97653	2	015688
98775332110	3	1333444777888
1100	4	

12. Which of the following are true statements?

- I. The sample sizes are the same.
- II. The medians are the same
- III. The means are the same.

- (A) I only
- (B) I and II
- (C) I and III
- (D) All of the above.
- (E) NOTA

13. Which of the following is true about the ranges and standard deviations?

- (A) The first set has both a greater range and a greater standard deviation.
- (B) The first set has a greater range, while the second has a greater standard deviation.
- (C) The first set has a greater standard deviation, while the second has a greater range.
- (D) The second set has both a greater range and a greater standard deviation.
- (E) NOTA

14. A random sample of 20 batteries are tested and show a mean life expectancy of 218 hours with a standard deviation of 11 hours. Determine a 90% confidence interval estimate for this mean life expectancy.

- (A) 218 ± 0.95
- (B) 218 ± 3.27
- (C) 218 ± 4.05
- (D) 218 ± 4.25
- (E) NOTA

15. What is the sample standard deviation of a set of 10 scores if

$$\sum(x - \bar{X})^2 = 90?$$

- (A) 3
- (B) $\sqrt{10}$
- (C) 9
- (D) 10
- (E) NOTA

16. A college alumni office states that 20% of graduates eventually become lawyers, 25% doctors, and 35% corporate executives. The remaining 20% are spread out among a variety of professions. A new survey taken of 625 graduates turned up 110 lawyers, 140 doctors, 250 corporate executives, and 125 others. Is there sufficient evidence that the percentages quoted by the alumni office have changed? Test at the 1% significance level.

- (A) No, with $\chi^2 = 2.82$ there is not sufficient evidence.
- (B) No, with $\chi^2 = 5.64$ there is not sufficient evidence.
- (C) No, with $\chi^2 = 7.954$ there is not sufficient evidence.
- (D) Yes, with $\chi^2 = 2.82$ there is sufficient evidence.
- (E) NOTA

17. A local restaurant owner claims that only 15% of visiting tourists stay for more than 2 days. A chamber of commerce volunteer is sure that the real percentage is higher. He plans to survey 100 tourists and intends to speak up if at least 18 of the tourists stay longer than 2 days. What is the probability of mistakenly rejecting the restaurant owner's claim if it is true?

- (A) .0357
- (B) .0714
- (C) .1428
- (D) .2005
- (E) NOTA

18. One medical report suggested that among a sample of 239 cesarean surgical procedures, 83 were unnecessary. What is a 99% percent confidence interval estimate for the proportion of cesareans that are unnecessary?

- (A) $.347 \pm .002$
- (B) $.347 \pm .060$
- (C) $.347 \pm .079$
- (D) $.347 \pm .227$
- (E) NOTA

19. Following are parts of the probability distributions for random variables x and y . If x and y are independent and two joint probabilities are $P(x = 1, y = 1) = .025$ and $P(x = 3, y = 3) = .08$ what is $P(x = 2, y = 2)$?

x	$P(x)$
1	.1
2	?
3	?

y	$P(y)$
1	?
2	?
3	.2

- (A) .115
- (B) .275
- (C) .333
- (D) .725
- (E) NOTA

20. Suppose X and Y are random variables with $\mu_x = 32, \sigma_x = 5, \mu_y = 44,$ and $\sigma_y = 12$. Given that X and Y are independent, what are the mean and standard deviation of the random variable $X + Y$?

- (A) $\mu_{x+y} = 76, \sigma_{x+y} = 8.5$
- (B) $\mu_{x+y} = 76, \sigma_{x+y} = 13$
- (C) $\mu_{x+y} = 76, \sigma_{x+y} = 17$
- (D) $\mu_{x+y} = 38, \sigma_{x+y} = 17$
- (E) NOTA

21. Company I manufactures bomb fuses that burn an average of 50 minutes with a standard deviation of 10 minutes, while Company II advertises fuses that burn an average of 55 minutes with a standard deviation of 5 minutes. Which company's fuse is more likely to last at least 1 hour? Assume normal distributions of fuse times.

- (A) Company I's because of its greater standard deviation.
- (B) Company II's because of its greater mean.
- (C) For both companies, the probability that a fuse will last at least 1 hour is 15.9%.
- (D) For both companies, the probability that a fuse will last at least 1 hour is 84.1%.
- (E) NOTA

22. According to a *USA Today/CNN* Gallup poll conducted on the final Thursday of the 1994 Winter Olympics, *USA Today* reported that speed skater Bonnie Blair had “won the USA’s heart.” When asked who was the hero of the Olympics, 65 per cent of the respondents chose Blair, who won five gold medals. The poll of 615 adults, done by telephone, had a margin of error of 4 percent. Which of the following statements best describes what is meant by the 4 percent margin of error?

- (A) About 4 percent of adults were expected to change their minds between the time of the poll and its publication in *USA Today*.
- (B) About 4 percent of adults of the 615 adults polled refused to answer.
- (C) Not all of the 615 adults knew anything about the Olympics.
- (D) The difference between the sample percentage and the population percentage is likely to be less than 4 percent.
- (E) NOTA

23. PCB contamination of a river by a manufacturer is being measured by amounts of the pollutant found in fish. A company scientist claims that the fish contain only 5 parts per million, but an investigator believes the figure is higher. In which of the following intervals is the P-value found if six fish are caught and show the following amounts of PCB (in parts per million): 6.8 , 5.6 , 5.2 , 4.7 , 6.3 , and 5.4 ?

- (A) $P < .01$
- (B) $.01 < P < .025$
- (C) $.025 < P < .05$
- (D) $P > .10$
- (E) NOTA

24. Which of the following is a criterion for choosing a t-test rather than a z-test when making an inference about the mean of a population?

- (A) The standard deviation of the population is unknown.
- (B) The mean of the population is unknown.
- (C) The sample size is less than 100.
- (D) The population is not normally distributed.
- (E) NOTA

25. If a player rolls two dice and gets a sum of 2 or 12, he/she wins \$20. If the person gets a 7, he/she wins \$5. The cost to play the game is \$3. Find the expectation of the game.

- (A) LOSE \$1.05
- (B) WIN 33¢
- (C) WIN \$1.05
- (D) WIN \$2.91
- (E) NOTA

26. Joe and Matthew plan to visit a bookstore. Based on their previous visits to this bookstore, the probability distributions of the number of books they will buy are given below.

Number of books Joe will buy	0	1	2	Number of books Matthew will buy	0	1	2
Probability	.50	.25	.25	Probability	.25	.50	.25

Assuming that Joe and Matthew make their decisions independently, what is the probability that they will purchase no books on this visit to the bookstore?

- (A) .0625
- (B) .125
- (C) .1875
- (D) .75
- (E) NOTA

27. The equation of the least squares regression line for the points on a scatterplot is $y = 1.3 + 0.73x$. What is the residual of the actual point (4,7)?

- (A) 2.78
- (B) 3.0
- (C) 4.22
- (D) 7.0
- (E) NOTA

28. The table shows the number of people from different age ranges enrolled in day and evening programs in a small community college. Assuming that there were no relationship between age and choice between day and evening classes, how many people over 30 years of age should be enrolled in evening programs?

	EVENING PROGRAM	DAY PROGRAM
Under 25 yrs	400	850
25 to 30 yrs	475	750
31 yrs & older	560	300

- (A) 370
- (B) 400
- (C) 490
- (D) 633
- (E) NOTA

29. Fayette County has 25,000 families. The number of cars owned by these families has a mean of 1.2 and a standard deviation of 0.90. 10% of the families have no cars. As part of an opinion survey, a simple random sample of 1,600 families is chosen. What is the chance that between 9% and 11% will not own cars?

- (A) 0.9999
- (B) 0.8176
- (C) 0.0007
- (D) 0.0266
- (E) NOTA

30. Which of the following is true about the regression output analyzing HSGPA and CollGPA?

Predictor	Coef	StDev	T	P
Constant	-0.1623	0.5350	-0.30	0.772
HSGPA	0.9797	0.1678	5.84	0.001

S = 0.3770 R-Sq = 85.0 % R-Sq (adj) = 82.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	4.8458	4.8458	34.09	0.001
Residual Error	6	0.8529	0.1422		
Total	7	5.6988			

- I. The regression equation is $y = -.1623x + .9797$
 - II. 85% of the variation in CollGPA can be explained by the regression equation.
 - III. There is a significant correlation between HSGPA and CollGPA at the .05 level.
- (A) I
 - (B) I and II
 - (C) II and III
 - (D) All of the above
 - (E) NOTA

Statistics Topic Test Answer Key
Mississippi 2002

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

