Statistics Topic Test
FAMAT State Convention 2002

For all questions, answer E. "NOTA" means none of the above answers is correct.
NOTE: if the appropriate *z* or *t* statistic is between two that are given in the table, average the two and use the average in your calculation(s).

1. In 1992, the mean SAT math score nationwide was 489, with standard deviation 100. The mean SAT verbal score was 496, also with standard deviation 100. What is the standard deviation of combined scores nationwide, correct to three decimal places? Assume that SAT scores are normally distributed, and research has demonstrated a strong positive correlation between students' math and verbal scores.

A. 200.000 B. 100.000 C. 70.711 D. 141.421 E. NOTA

2. In the following table, which shows the gender breakdowns of students voting for Joe and Sally for senior class president, what value for *n* would result in a table showing perfect independence between gender and candidate preference?

	Joe	Sally
Boys	*n*	52
Girls	35	10

A. 17 B. 27 C. 77 D. 182 E. NOTA

3. In Mikey's Algebra II class, Tonya reveals that her birthday is July 17th. Supriya exclaims, "that's amazing! My birthday is July 17th, too!" What is the minimum number of students do there need to be in Mikey's Algebra II class to ensure that there is a greater than 75% chance that any two of them will have the same birthday? (365 days in a year)

A. 274 B. 35 C. 32 D. 29 E. NOTA

4. In a simple random sample of five games, Rasheed Wallace of the Portland Trailblazers scores 21, 31, 18, 15, and 24 points. Which of the following is a 95% confidence interval for Wallace's true points per game (PPG) average, correct to three decimal places?

A. 21.800 ± 8.522 B. 21.800 ± 7.060 C. 21.800 ± 7.623 D. 21.800 ± 7.893 E. NOTA

5. By the way, what does the aforementioned confidence interval (i. e., that in problem 4) mean?

A. In 95% of games, Wallace scores a point total in this interval.
B. In 95% of five game stretches, Wallace averages a PPG average in this interval.
C. There is a 95% chance that Wallace's true PPG average falls in this interval.
D. There is a 95% chance that the interval is one of all similar intervals that does captures Wallace's true PPG average.
E. NOTA

6. A simple random sample of 532 undergraduates polled at Harvard reveals that 92 are majoring in biology. Give a 99% confidence interval for the true proportion of Harvard undergraduates majoring in biology, correct to three decimal places.

A. 0.173 ± 0.042 B. 0.173 ± 0.032 C. 0.173 ± 0.038 D. 0.173 ± 0.024 E. NOTA

For problems 7 and 8, use the following information:
I read in *Rolling Stone* magazine that the average song length in Pink Floyd's catalogue of all their songs is 4:24 (minutes:seconds) with a standard deviation of 1:12. I think the mean's higher than that (though I accept that we know the standard deviation!). Being the skeptic that I am, I take a simple random sample of six songs. They average 5:01 in length. I decide to test *Rolling Stone*'s claim with a 5% significance test.

7. What is the probability that, after having conducted my test, I will make a Type I error?

A. 0.050 B. 0.285 C. 0.715 D. 0.950 E. NOTA

8. What is the probability that, after having conducted my test, I will make a Type II error?
A. 0.050 B. 0.285 C. 0.715 D. 0.950 E. NOTA

9. A box contains glass lenses used for traffic signals. Five of the lenses are red, 4 are yellow and 3 are green. If two of the lenses are randomly selected from the box, find the probability that the first lens is red and the second lens is green. Assume that the first lens is not replaced before the second lens is selected. Give the answer as a decimal rounded to the nearest thousandth.
A. 0.046 B. 0.104 C. 0.114 D. 0.152 E. NOTA

10. Which of the following is characteristic of a binomial distribution, but NOT of a geometric distribution?

A. There is a fixed number of observations.
B. The observations are all independent.
C. Each observation has only two outcomes: "success," or "failure."
D. The probability of success is the same for each observation.
E. NOTA

11. Suppose the mean length of an earthworm is 2.3 inches. What is the standard deviation of earthworm lengths, to the nearest hundredth of an inch, if 25% of earthworms are longer than 2.8 inches? Assume that earthworm lengths are normally distributed.

A. 0.56 B. 0.74 C. 0.50 D. 0.67 E. NOTA

12. Dr. Yau runs various mice through a maze, recording the amount of time that it takes each one to run through. One of the mice takes an abnormally long time to complete its maze odyssey. Which of the following statistics of the mice's times is the slow mouse likely to affect?
I. Mean II. Standard Deviation III. Interquartile Range IV. Median V. Range

A. I, II, and III
B. I and II
C. I, II, III, and V
D. I, II, and V
E. NOTA

13. After a great deal of exhaustive research, Daniel determines that the answer choice "E. NOTA" is correct on 30-question multiple choice Mu Alpha Theta tests (like this one) an average of 3.5 times per test. He also finds that "A," "B," "C," and "D" are correct in equal frequency. If Daniel always answers 20 questions correctly based on his own knowledge and guesses "B" for the rest, what is his average score if he takes many such tests, to three decimal places? Assume, of course, that he gets 4 points for every correct response and –1 for every incorrect response, that his research has yielded correct results, and that there are only five choices for every question.

A. 80.000 B. 78.958 C. 81.042 D. 82.147 E. NOTA

For questions 14 and 15, use the following information:
In 1941, Joe DiMaggio had a batting average of 0.381. Assume that DiMaggio had four at-bats per game, and that every at-bat resulted in either a strikeout or a safe hit. Assume also that DiMaggio's at-bats were all independent.

14. Based on the above data, what was DiMaggio's average number of games in a row ("hitting streak") in which he hit safely in 1941, to the nearest game?

A. 2 B. 3 C. 6 D. 7 E. NOTA

15. Give the probability, based on the above data, that in a 56 game stretch DiMaggio will hit safely in all 56 games. Round your answer to three decimal places.

A. 1.376×10^{-4} B. 2.181×10^{-12} C. 2.161×10^{-12} D. 1.612×10^{-4} E. NOTA

16. You flip a fair coin ten times. What is the probability, correct to three decimal places, that at least two-fifths of the flips turn up heads?

A. 0.828 B. 0.700 C. 0.742 D. 0.600 E. NOTA

17. At Shelbyville High, 6% of students take Statistics. 25% of students taking Statistics are National Honor Society members, and 15% of students not taking Statistics are National Honor Society members. If a student is a National Honor Society member, what is the probability that the student does not take Statistics, correct to three decimal places?

A. 0.681 B. 0.759 C. 0.904 D. 0.843 E. NOTA

18. In Springfield, two rival pizza companies, Happy Times Pizza and Speedy Pizza, have deals where if they deliver your pizza late (late being 30 or more minutes after it has been ordered), the pizza is free. Statisticians working for the pizzerias perform studies on the frequency of pizza delivery tardiness of the two companies using data from the same week during daytime and nighttime hours and claim the following:
The statistician for Happy Times Pizza claims that Speedy Pizza delivers pizza late with more frequency than does Happy Times Pizza overall.
The statistician for Speedy Pizza claims that Happy Times Pizza delivers pizza late with more frequency than does Speedy Pizza during both the daytime and nighttime hours.
Is this possible?

A. No, one of the two statisticians has made an error.
B. No, because if the Speedy Pizza statistician is correct, then by weighted summation of the corresponding percentages of daytime and nighttime late pizzas, Happy Times Pizza must deliver pizzas late with more frequency overall.
C. No, because if the Happy Times Pizza statistician is correct, then Speedy Pizza delivers late pizzas with more frequency than Happy Times Pizza during the nighttime hours, daytime hours, or both.
D. Yes, both statisticians could be correct.
E. NOTA

19. A surveyor seeking the opinions of female mallgoers plans to interview every one-hundredth female entering the mall from the time that it opens to the time that it closes one day. Is this a simple random sample of female mallgoers for that day?

A. No, because not every group has an equal chance of being selected.
B. Yes, because each female mallgoer has an equal chance of being selected.
C. Yes, but only if the mall has a single entrance.
D. Yes, because this is an example of systematic sampling, which is equivalent to a simple random sample.
E. NOTA

20. A simple random sample of 476 fans at an 'N Sync concert were asked "did you already own the band's CD before attending the concert?" 278 responded in the affirmative. The same question was posed to a simple random sample of 588 fans at a Backstreet Boys concert, to which 294 responded in the affirmative. Give a 95% confidence interval (to three decimal places) for the positive difference between the proportions of 'N Sync fans and Backstreet Boys fans who already owned the band's CD before attending the concert.

A. 0.084 ± 0.042 B. 0.084 ± 0.031 C. 0.084 ± 0.050 D. 0.084 ± 0.060 E. NOTA

21. An increase in which of the following will decrease the margin of error in a confidence interval using *z* procedures, holding everything else constant?

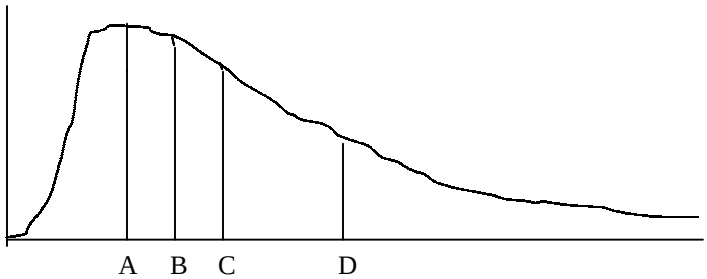
A. The difference between the sample mean and the hypothesized value of μ.
B. z^*, the critical *z* statistic.
C. σ, the population standard deviation.
D. *n*, the sample size.
E. NOTA

22. How many of the following are quantitative variables?

Eye color	ZIP Code	Score on this test	100 Meter Dash Time	Blood Type
Processing Speed	Calculator Model	Age in months	P. O. Box Number	# of quantitative variables

A. 4 B. 5 C. 6 D. 7 E. NOTA

23. In the following, which of the following are most likely the mean and median?



A. A is both the mean and the median
B. D is the mean, C is median.
C. C is the mean, B is the median.
D. D is the mean, B is the median.
E. NOTA

24. Given the following information:
$s_x = 4$ $s_y = 1$ $b = 1/8$ $a = 1/6$
Where $y = ax + b$ is the linear regression for *y* versus *x*, give the value of *r*, the correlation coefficient.

A. 1/4 B. 1/3 C. 2/3 D. 1/2 E. NOTA

25. Suppose $P(X) = 0.350$ and $P(Y) = 0.400$. If $P(X \mid Y) = 0.280$, what is $P(Y \mid X)$?

A. 0.140 B. 0.320 C. 0.500 D. 0.700 E. NOTA

26. 1000 adults, selected as a simple random sample, representing Democrats, Republicans, and Independents were asked if their confidence in the nation's economy had been shaken by the recent bear market. The results were as follows:

	Yes	No	No opinion
Democrats	175	220	55
Republicans	150	165	35
Independents	75	105	20

Give the χ^2 statistic for the null hypothesis that a shaken confidence in the U. S. economy is independent of party affiliation, correct to three decimal places.

A. 350.450 B. 16.246 C. 7.456 D. 3.024 E. NOTA

27. Which of the following regarding the correlation coefficient *r* are true?

I. When $r = 0$, there is no relationship between the variables.
II. When $r = .5$, 50% of the variation in one variable is caused by variation in the other.
III. When $r = 1$, there is a perfect cause-and-effect relationship between the variables.

A. I only B. II only C. III only D. I, and III E. NOTA

28. Which of the following characteristics of a distribution can stemplots show?

I. Symmetry II. Gaps III. Clusters IV. Outliers

A. I, II, and III B. I, II, and IV C. I, III, and IV D. I, II, III, and IV E. NOTA

29. Which of the following are true statements?

I. Even if the original population distribution is badly skewed, the mean of the set of all sample means from all samples of a given size will equal the mean of the population.
II. If the original population is very large, it is usually advisable to work with a large sample.
III. A confidence interval estimate for a population mean is use to eliminate the element of chance from the estimation.

A. I only B. II only C. II and III D. I and III E. NOTA

30. Suppose the correlation between two variables is $r = 0.190$. What is the new correlation if 0.230 is added to all values of the *x*-variable, every value of the *y*-variable is double, and then the two variables are interchanged?

A. 0.190 B. 0.380 C. 0.420 D. 0.610 E. NOTA