

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

1. What is the range of the following data:  $\{-5, 3, -2, 7, 10\}$ ?  
(A) 4                      (B) -10                      (C) 5                      (D) 15                      (E) NOTA
  
2. A group of friends got the following test scores:  $\{6, 7, 7, 8, 8, 8, 10, 10\}$ . By how much does the mode of their scores change if they let another friend into their group who scored a 4?  
(A)  $\frac{1}{2}$                       (B) 0                      (C)  $-\frac{1}{2}$                       (D) 2                      (E) NOTA
  
3. A player's Batting Average is the number of hits made divided by the number of times at bat. Mark stepped up to bat 30 times this season and made 10 hits. Jose went to bat 5 times: striking out three times and hitting two home runs. Susan went to bat 7 times and hit a single every time. Jeff went to bat 20 times and made 7 hits. Who has the worst Batting Average for the season?  
(A) Mark                      (B) Jose                      (C) Susan                      (D) Jeff                      (E) NOTA
  
4. A pitcher's Earned Running Average is the number of earned runs that the pitcher is expected to give up in a game of 9 innings. If Cecila has pitched two innings and given up five earned runs, what is her Earned Running Average?  
(A) 5                      (B) 22.5                      (C) 45                      (D) 18                      (E) NOTA
  
5. Patrick went fishing. Past experience shows that 60% of the time he doesn't catch any fish, 20% of the time he catches 1 fish, and 20% of the time he catches 2 fish. How many fish is he statistically expected to catch?  
(A) 0                      (B) .6                      (C) .8                      (D) 1                      (E) NOTA
  
6. Scores on an I.Q. test are normally distributed with mean 100 and standard deviation 16. Larry's I.Q. score places him in the 87<sup>th</sup> percentile. To the nearest whole number, what is his I.Q. score?  
(A) 104                      (B) 105                      (C) 114                      (D) 118                      (E) NOTA.
  
7. Louis goes to Vegas. For every dollar he bets on the slot machines his expected return is 98 cents. He has five one-dollar bills in his wallet. He bets each in turn. If Louis does this every day for a year, how much do you expect him to leave with on average? Give your answer to the nearest cent.  
(A) \$4.90                      (B) \$5.00                      (C) \$5.98                      (D) \$4.98                      (E) NOTA

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

8. Louis's sister walks into the casino with a five-dollar bill. She plays a game where she can bet any amount of money, and the expected return is 98%. She bets her \$5 all at once. She does this every day for year. On average, how much money is she expected to walk away with each day? Give your answer to the nearest cent.
- (A) \$5.98      (B) \$4.90      (C) \$4.96      (D) \$0.98      (E) NOTA
9. Louis's other sister starts with \$5, and bets everything she has three times in a row at the 98% expected return game. She does this every day for a year. On average, how much is she expected to walk away with each day? Give your answer to the nearest cent.
- (A) \$4.71      (B) \$4.90      (C) \$4.94      (D) \$4.64      (E) NOTA
10. The four members of a relay team take {4.2 , 5.0, 4.8, 4.0} seconds. How much faster than their mean is the fastest swimmer?
- (A) .2 seconds      (B) .4 seconds      (C) .5 seconds      (D) .6 seconds      (E) NOTA
11. When is the mean of a set of data the same as its median?
- (A) Never the same  
(B) If the mean is a point in the set of data  
(C) If the data is distributed symmetrically about the mean  
(D) If there is an odd number of pieces of data  
(E) NOTA
12. Lisa keeps track of when the school bus arrives to the nearest minute. The first thirty days of school it arrives between 7:45 AM and 7:50 AM. The 31<sup>st</sup> day it snows, and the bus arrives at 9 AM. Which statistic of the arrival times, mean, median, or mode, is changed the most when the 31<sup>st</sup> day data is added to the first thirty days' data?
- (A) Mean      (B) Median  
(C) Mode      (D) It is not possible to tell      (E) NOTA
13. A 99% confidence interval for the length in feet of a species of snake was computed using 85 samples. The confidence interval is [4.3, 7.15]. What is the standard deviation, to the nearest tenth of a foot, of the length of this species of snake?
- (A) .5      (B) 1.3      (C) 5.1      (D) 7.0      (E) NOTA.

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

14. A not-so-famous economist noted that the squirrel population of New York State and the New York Stock Exchange had both increased over a certain four-year period. What major issue in statistics does this bring up?
- (A) Experiments should be properly controlled  
(B) Correlation is not the same as causation  
(C) Test populations must be large enough to test the desired hypothesis  
(D) The placebo effect  
(E) NOTA
15. A survey showed that 30% of students were in sports, 50% had divorced parents, and 10% smoked cigarettes. If 200 students participated in the survey how many of these students were in sports and smoked cigarettes?
- (A) 6                      (B) 20  
(C) 60                      (D) It is not possible to tell from this information                      (E) NOTA
16. A teacher gives his class of 30 students a test with ten questions each worth 1 pt (no partial credit). He announces that the mean score is 7.5. Then the teacher asked, “How many students had scores below the mean?” Which of the following answers are not possibly the right answer to that question?
- (A) 15                      (B) 12                      (C) 10                      (D) 7                      (E) NOTA
17. In the case of Connecticut vs. Teal, it was alleged that discriminatory testing for promotions was taking place. Given only the information that 11% of people who passed the promotion test were “cyan” and 89% of people who passed the test were “magenta”, what can be concluded?
- (A) There was discrimination against “cyans”  
(B) There was discrimination against “magentas”  
(C) There was no discrimination  
(D) Nothing can be concluded from the given statistics  
(E) NOTA
18. Scores on a national test are known to have mean 250 and standard deviation 50. When testing groups of 100 students, what percent (to two decimal places) of the time would you expect to see a mean of 260 or larger?
- (A) 2.28%                      (B) 21.04%                      (C) 42.07%                      (D) Almost never                      (E) NOTA.
19. What is the variance of the following set of data? {0, 10, 20, 30, 100}
- (A) 27.2                      (B)  $\sqrt{1570}$                       (C) 1570                      (D) 10000                      (E) NOTA

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

20. A school has two fourth grade classes, Mr. Tuck's and Mr. Buck's. Mr. Tuck's class has 28 students who scored an average of 78% on the national standards exam. Mr. Buck's class has 30 students who scored an average of 81% on the national standards exam. What is the average fourth-grader score (to the nearest percent) for the whole school?

- (A) 79%                      (B) 80%  
(C) 81%                      (D) It is not possible to tell from the information given (E) NOTA

21. A data set has mean 49.3 and variance 5.76. What is the standard deviation of the data set?

- (A) 1.86                      (B) 2.24                      (C) 2.56                      (D) 2.88                      (E) NOTA

22. Kids in the blue math group score {24, 56, 74, 77, 78, 78, 82, 84, 86, 88, 94} on a test out of 100 points. The teacher decides to curve the scores by adding a constant to all the scores such that the top student ends up with a score of 100.

If an 'A' goes to anyone 90% or above, how many students end up with A's?

- (A) 1                              (B) 2                              (C) 3                              (D) 4                              (E) NOTA

23. From problem 22, how much does the mean score change from before the curve to after the curve?

- (A) 0                              (B) 6                              (C) 8                              (D) 10                              (E) NOTA

24. We have strong reason to believe that 25% of parents favor year-round school. What size sample would we need to collect to construct a 95% confidence interval with margin error no more than .01?

- (A) 85                              (B) 7203                              (C) 9604                              (D) 12433                              (E) NOTA.

Mu Alpha Theta National Convention: Denver, 2001  
 Statistics Topic Test – Open Division

25. A sea captain was given some experimental sea-sickness pills and asked to test them out by giving some voyagers the pill and some voyagers a placebo to act as a control.

The captain returned and said the pills worked great - those who took them were fine and those who didn't take the pills got seasick. However, the statistician in charge was upset to find out that the captain had given the experimental pills to his crew and the placebos to the passengers. Why did the statistician feel the test was invalid?

- (A) There were fewer members of the crew than passengers
  - (B) The crew would know that they had the real pills and thus there may have been a placebo effect
  - (C) The test was biased because the crew was not as likely to get seasick as the passengers even without the test pill
  - (D) The passengers did not have orders to take their pills
  - (E) NOTA
26. Researchers want to test the effect of smoking a cigarette on the blood level of regular smokers. They will test smokers' blood levels before and after the subject smokes a tobacco cigarette. Which set of controls would make for a valid experiment?
- (A) A test group of non-smokers that smoke a cigarette.
  - (B) A test group of non-smokers that do not smoke a cigarette.
  - (C) A test group of smokers that do not smoke a cigarette, and a test group of smokers who chew chewing gum.
  - (D) A test group of smokers that do not smoke a cigarette, and a test group of smokers that smoke a tobacco-less cigarette.
  - (E) NOTA
27. We want to test the hypothesis that *gender* and *interest in football* are related. The null hypothesis for this experiment is independence. Use the data below, and the appropriate hypothesis test, to find the p-value of this experiment.

	Very interested	Ambivalent	Dislike
Male	20	35	42
Female	27	28	30

- (A)  $p > .1$       (B)  $.05 < p < .1$     (C)  $.01 < p < .05$     (D)  $p < .01$     (E) NOTA.

Mu Alpha Theta National Convention: Denver, 2001  
 Statistics Topic Test – Open Division

28. In a pet store, it is noted that the length of female guppies is normally distributed with mean 18 and variance 1, and the length of male guppies is normally distributed with mean 13 and variance 16. You are told that a particular guppy is 16 mm long. From which gender is it more likely to come?

- (A) Female
- (B) Male
- (C) Equally likely to be from either gender
- (D) It is not statistically likely to have come from either gender
- (E) NOTA

29. In Seattle the probability of rain on a day in March is 75%. Let X be the number of rainy days in a week in March in Seattle. Of the following, which distribution is the best statistical model for X?

- (A) Uniform distribution
- (B) Gaussian distribution
- (C) Binomial distribution
- (D) Poisson distribution
- (E) NOTA

30. In a certain part of Africa the average probability that it rains during a day is .0023%. Let Y be the number of rainy days over a century for that region. Of the following, which distribution is the best statistical model for Y?

- (A) Uniform distribution
- (B) Gaussian distribution
- (C) Binomial distribution
- (D) Poisson distribution
- (E) NOTA

31. You want to approximate drawing a random number from a normal distribution with mean 0 and variance 1, but all you have to work with is a fair six-sided die. Which of the following will give you the best approximation?

- (A) (Roll one die  $-3.5$ ) x (another roll of the die)/9
- (B) (Roll one die  $- 3.5$ )<sup>-1</sup>
- (C) (Sum six rolls of the die  $- 21$ )/4
- (D) (Multiply two rolls of the die  $- 12.25$ )/9
- (E) NOTA

32. To test the effectiveness of a cholesterol lowering medication, 8 subjects had their cholesterol levels measured before and after using the medication for 3 months. Use the data below, and the appropriate hypothesis test, to find the p-value of this experiment.

Subject	A	B	C	D	E	F	G	H
Before	188	293	165	316	204	277	347	260
After	190	274	160	297	183	286	360	231

- (A)  $p > .1$
- (B)  $.05 < p < .1$
- (C)  $.01 < p < .05$
- (D)  $p < .01$
- (E) NOTA.

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

33. Each week your parents draw your salary from a Gaussian distribution with mean \$10 and variance \$4. (They admit there is a small chance that you will end up ‘owing’ them money, due to the infinite tails of the Gaussian). Let  $S$  be the sum of your last four weekly salaries. What is the distribution of  $S$ ?
- (A) Gaussian with mean \$40 and variance \$16  
(B) Gaussian with mean \$40 and variance \$8  
(C) Gaussian with mean \$40 and variance \$4  
(D) Exponential with mean \$40  
(E) NOTA
34. In a group of parents surveyed, 60% had two children and 40% had one child. Of the families with two children, 25% own SUV’s. Only 10% of the families with one child own SUV’s. You meet a parent in the group who owns an SUV. To the nearest percent, what is the probability that he has two children?
- (A) 15%            (B) 36%            (C) 79%            (D) 88%            (E) NOTA
35. A least squares regression model has the property of:
- I. Minimizing the sum of the squared distances between observed and predicted data points.  
II. Minimizing the slope of the regression line.  
III. Minimizing the sum of the squared distances between the observed  $y$  values and the predicted  $y$  values.
- (A) I only        (B) II only        (C) III only        (D) Two of the above.        (E) NOTA
36. Data was collected to study the relationship between SAT scores and final High School grade point average. Using G.P.A. as the independent variable, the linear regression equation was  $\hat{y} = 455 + 110x + \varepsilon$  and the correlation coefficient was .90. Based on this information, which of the following statements is true?
- I. Having a higher G.P.A. causes one to have a higher SAT score.  
II. The regression model explains 81% of the variation in the data.  
III. We can say with 90% confidence that a person with a G.P.A. of 2.5 will score 730 on the SAT.
- (A) I only.        (B) II only.        (C) III only.        (D) More than one is true.        (E) NOTA

Mu Alpha Theta National Convention: Denver, 2001  
Statistics Topic Test – Open Division

37. Which of the following statements regarding a one-sample hypothesis test is true?

- I. Quadrupling the sample size doubles the standard error.
- II. The Central Limit Theorem guarantees that as  $n$  becomes large, the standard deviation of the parent population becomes smaller.
- III. A Type II Error means that we have rejected a true null hypothesis.

(A) I only. (B) II only. (C) III only. (D) More than one is true. (E) NOTA

38. In group A, 62 out of 120 people approve of the President's performance. In group B, 60 out of 150 approve of the President's performance. We want to know if there is sufficient evidence to say that the groups are different. Determine the  $p$ -value for this test.

(A)  $p > .1$  (B)  $.05 < p < .1$  (C)  $.01 < p < .05$  (D)  $p < .01$  (E) NOTA.

39. An analysis of variance (ANOVA) was performed to test 5 groups for difference of means. Using  $\alpha = .05$ , we looked in an  $F$  table and found the critical  $F$  value for this test was 2.71. What was the total number of subjects in the study?

(A) 20 (B) 25 (C) 28 (D) 33 (E) NOTA

40. A distribution has an interquartile range of 30. Which of the following could possibly be the boxplot for the distribution?

(A) (B)

(C) (D)

(E) NOTA