

Mu Alpha Theta National Convention 2004

Mu Statistics

For all questions, the answer "E. NOTA" means none of the above answers is correct.

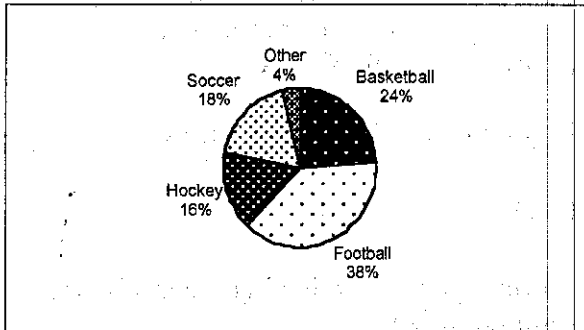
1. Mike had a z-score of 2.98 on his mathematics exam. If the mean was 75.2 and the standard deviation was 6.2, what was Mike's actual score?  
 A. 94.2      B. 93.7      C. 95.2      D. 96.1      E. NOTA
  
2. In a distribution of 600 values, the mean is 75 and the standard deviation is 12. Using Chebyshev's Theorem, at least how many values will be less than 51 or more than 99?  
 A. 25      B. 450      C. 150      D. 75      E. NOTA
  
3. Using the data set of: 10, 12, 13, 15, 18, 20, 25, 27, 32, 36, 39, and 40, what is the interquartile range?  
 A. 20      B. 19      C. 21      D. 18      E. NOTA
  
4. A random sample of size 16 is to be taken from a normal population having mean 100 and variance 4. What is the 90<sup>th</sup> percentile of the distribution of  $\bar{x}$ ?  
 A. 97.44      B. 100.08      C. 100.32      D. 100.64      E. NOTA
  
5. In Chemistry, weights are assigned to required activities as follows:  
 class participation - 15%; exam 1 - 20%; exam 2 - 20%; exam 3 - 20%; laboratory 25%  
 Each activity is graded on a 100 point scale. Mary earned 70 points on class participation, 80 points on exam 1, 64 points on exam 2, 77 points on exam 3, and 96 points on laboratory. Compute her overall weighted average in the Chemistry class.  
 A. 78.7      B. 77.4      C. 100      D. 78.2      E. NOTA
  
6. A random sample of 30 receipts for individuals shopping at the CVS Drug Store showed the sample mean to be  $\bar{x} = \$28.19$  with sample standard deviation  $s = \$4.06$ . Compute the coefficient of variation for this data.  
 A. 6.94%      B. 14.4%      C. 0.48%      D. 4.32%      E. NOTA
  
7. In a Calculus class there are 11 freshmen and 15 sophomores; 5 of the sophomores are females and 8 of the freshmen are males. If a student is selected at random, what is the probability of selecting a sophomore or a male?  
 A.  $\frac{23}{26}$       B.  $\frac{3}{26}$       C.  $\frac{33}{26}$       D.  $\frac{5}{13}$       E. NOTA
  
8. Box A contains 4 red and 6 blue balls. Box B contains 5 red and 10 blue balls. A box is selected at random and a ball is drawn. Given that the ball drawn is red, what is the probability that it came from Box A?  
 A.  $\frac{5}{11}$       B.  $\frac{6}{11}$       C.  $\frac{1}{5}$       D.  $\frac{2}{5}$       E. NOTA

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9. A survey of 500 teenagers was taken to see which sport was their favorite to watch on television. The pie chart below displays the results. Choose the correct data (numbers of teenagers) from which the pie chart was constructed.



- A. Basketball – 190; football – 120; hockey – 90; soccer – 80; other – 20  
 B. Basketball – 120; football – 190; hockey – 90; soccer – 80; other – 20  
 C. Basketball – 20; football – 90; hockey – 80; soccer – 190; other – 120  
 D. Basketball – 120; football – 190; hockey – 80; soccer – 90; other – 20  
 E. NOTA
10. The probability that it will snow in Cincinnati, Ohio on December 25 is 0.40. Given that it is snowing in Cincinnati, the probability that it is snowing in Columbus, Ohio is 0.65. What is the probability that it will snow both in Cincinnati and Columbus on December 25?  
 A. 1.05      B. 0.25      C. 0.26      D. 0.74      E. NOTA
11. If  $p(A \text{ and } B) = 0.0$  then we know that  
 A. A and B are dependent events      B. A and B are mutually exclusive  
 C. A and B are independent      D.  $A = B$       E. NOTA
12. For the following probability distribution find the variance.

X	0	1	2	3	4
P(X)	0.26	0.34	0.25	0.12	0.03

- A. 7.50      B. 1.32      C. 2.39      D. 5.76      E. NOTA
13. A carton of 12 eggs contains 2 cracked and spoiled eggs. If two eggs are selected at random, what is the probability that one of the eggs is cracked and spoiled?  
 A. 0      B. 0.3030      C. 0.2778      D. 0.0278      E. NOTA

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14. Identify the sampling technique used in the following samples;
- I. Every tenth customer entering a health club is asked to select his or her preferred method of exercise.
  - II. Divide the subscribers of a magazine into three different income categories and then select a random sample from each category to survey about their favorite feature.
  - III. Take a sample of six Zip codes from the Minneapolis metropolitan region and all the car dealerships in the selected areas. Determine the number of new cars sold each month at each dealership.
  - IV. Use a random number table to select a sample of books and determine the number of pages in each book.
  - V. Determine the annual salary of each of the nurses that are on duty at the time you chose to interview at the hospital.
- A. cluster, convenience, simple random, stratified, systematic
  - B. systematic, stratified, cluster, simple random, convenience
  - C. stratified, systematic, simple random, cluster, convenience
  - D. simple random, stratified, cluster, convenience, systematic
  - E. NOTA
15. You wish to estimate the average life of light bulbs to within 10 hours. If the standard deviation for the life of the light bulbs is 75 hours, how many bulbs do you need to sample if you wish to be accurate 95% of the time?
- A. 216      B. 346      C. 153      D. 217      E. NOTA
16. In a normal distribution, if the mean is 500 and 3.62% of the distribution lies to the right of 572, what is the standard deviation?
- A. 80      B. 40      C. 130      D. 50      E. NOTA
17. The equation of the least squares regression line for a set of points in a scatterplot is given by  $\hat{y} = 1.3 + 0.27x$ . The point (3, 2) is one point on this scatterplot. Which of the following is the residual for the point (3, 2)?
- A. -0.11      B. 0.11      C. 0.22      D. 1.04      E. NOTA
18. A sample of 2172 was used to estimate a proportion with 98% confidence. If  $p=0.5$ , what was the margin of error?
- A. 0.025      B. 0.035      C. 0.028      D. 0.032      E. NOTA
19. Failing to reject a null hypothesis that is false can be characterized as
- A. a Type I error
  - B. a Type II error
  - C. both a Type I and Type II error
  - D. a standard error of the mean
  - E. NOTA
20. If a 95% confidence interval is given by (86.52, 89.48), which of the following could be a 99% confidence interval for the same data?
- A. (86.98, 89.02)      B. (86.37, 89.63)      C. (87, 89)      D. (87.4, 88.6)      E. NOTA

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21. A recent survey showed that in a sample of 60 nurses, 35 smoked, while in a sample of 70 doctors, 25 smoked. Test to see if there is a difference in the proportion of those who smoke at  $\alpha = 0.05$ . Which of the following statements is **incorrect** concerning this hypothesis test?

- A. The pooled estimate of the population variance is  $\frac{6}{13}$ .  
 B. The standard error of difference is 0.086.  
 C. The test value is 2.36.  
 D. The decision is to reject the null hypothesis.  
 E. NOTA

22. A newspaper reporter recently made the claim that 46% of the voters support the Speaker of the House. The Speaker doubting this claim surveyed 1000 voters and found that 490 supporter his positions. Test at the 1% level the claim of the reporter. Calculate the test statistic for this test.

- A.  $t = 1.89$                       B.  $z = 1.90$                       C.  $p = 0.49$                       D.  $\hat{p} = 0.46$   
 E. NOT

23. A study of corporate business costs was conducted to determine if there was a difference between the average amount spent on dinner by executives and the average amount spent on dinner by managers. Data are below:

Executives  
 $\bar{x}_1 = 25.50$   
 $\sigma_1 = 4.75$   
 $n_1 = 32$

Managers  
 $\bar{x}_2 = 22.5$   
 $\sigma_2 = 2.83$   
 $n_2 = 35$

What is the 99% confidence interval of the true differences in the means?

- A.  $\$0.51 < \mu_1 - \mu_2 < \$5.49$                       B.  $\$0.59 < \mu_1 - \mu_2 < \$5.41$   
 C.  $\$0.51 < \mu_1 - \mu_2 < \$5.49$                       D.  $\$0.75 < \mu_1 - \mu_2 < \$5.25$   
 E. NOTA

24. Data are obtained for a group of teachers examining the relationship between years of experience ( $x$ ) and salary ( $y$ ), in thousands of dollars. The resulting regression equation is  $\hat{y} = 20.17 + 0.82x$  with  $r = 0.597$ . What percent of the variation is salary can be explained by the least squares regression of salary on years of experience?

- A. 0.2017%                      B. 20.17%                      C. 35.6%                      D. 59.7%                      E. NOTA

25. Quality control studies for Dependable Dishwashers show the lifetime of a dishwasher follows a normal distribution with mean  $\mu = 8$  years and standard deviation  $\sigma = 1.2$  years. The company will replace any dishwasher that fails during the guarantee period. How long should the company's dishwashers be guaranteed if the company wishes to replace no more that 2% of the dishwashers?

- A. 0.16 year                      B. 0.13 year                      C. 5.54 years                      D. 10.5 years                      E. NOTA

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26. The following data were obtained for the life expectancy of males and females in eight African countries.

Females (x)	53	61	53	63	66	67	54	58
Males (y)	54	60	50	59	63	61	52	57

Find the regression line. What would be the life expectancy (to the nearest year) for a male in an African country where the female life expectancy is 58 years?

- A. 54      B. 53      C. 76      D. 56      E. NOTA

27. The following numbers were randomly generated by a computer:

35    50    20    27    76    33    31    5    49    64    63    12    13  
4    30    45    29    16    71    11    89    40    81    77    46

Numbers 1-19 represent freshmen, 20-49 represent sophomores, 50-69 represent juniors, and 70-89 represent seniors. How many sophomores were selected?

- A. 5      B. 3      C. 10      D. 11      E. NOTA

28. A real estate agent found that there is a significant relationship between the number of acres ( $x_1$ ) on a farm, the number of rooms in the farm house ( $x_2$ ), and the selling price in thousands of dollars ( $\hat{y}$ ). The multiple regression line was calculated as follows:

$$\hat{y} = 243.7 - 0.037x_1 + 7.35x_2.$$

If a farm has 450 acres and the farmhouse has 5 rooms, what is the predicted selling price of the farm?

- A. \$286,700    B. \$297,100    C. \$263,800    D. \$278,500    E. NOTA

29. What is the smallest sample size we should select if we wish to develop a 90% confidence interval for the average diameter of the washers produced by ABC Parts Company, yet we wish to have a margin of error of no more than  $\pm 0.02$  mm? Assume our manufacturing process results in a standard deviation of 0.035 mm.

- A. 3      B. 8      C. 17      D. 95      E. NOTA

30. A set of data has the following five-number summary:

minimum = 17, first quartile = 27, median = 40, third quartile = 49, maximum = 90.

Which of the sets of numbers below contain all outliers?

- A. 83, 85, 90    B. 75, 80, 85    C. 2, 3, 85, 90    D. 0, 80, 84    E. NOTA

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**Tie Breaker 1**

The mean diameter of a type of bearing is supposed to be 2.000 centimeters (cm). The bearing diameters vary normally with standard deviation  $\sigma = .010$ cm. When a lot of the bearings arrives, the consumer takes a simple random sample of 5 bearings from the lot and measures their diameters. The consumer rejects the bearings if the sample mean diameter is significantly different from 2.000 at the 5% significance level.

This is a test of the hypotheses

$$H_o: \mu = 2.000\text{cm.}$$

$$H_a: \mu \neq 2.000\text{cm.}$$

Calculate the probability of a Type II error if the true mean is 2.015 cm.

**Tie Breaker 2**

The Advanced Placement (AP) Statistics examination was first administered in May 1997. Student papers are graded on a scale of 1 to 5, with 5 being the highest score. Over 7600 students took the exam in the first year and the distribution of scores was as follows (not including exams that were scored late):

Score	5	4	3	2	1
Percent	15.3	22.0	24.8	19.8	18.1

A sample of students who took the exam had the following distribution of grades:

Score	5	4	3	2	1
Frequency	167	158	101	79	30

If you perform a test for goodness of fit, what is the value of the test statistic?

**Tie Breaker 3**

A midterm exam in Applied Mathematics consists of problems in 8 topical areas. One of the teachers believes that the most important of these, and the best indicator of overall performance, is the section on problem solving. She analyzes the scores of 36 randomly chosen students using computer software and produces the following printout relating the total score to the problem-solving subscore, ProbSolv:

Predictor	Coef	StDev	T	P
Constant	12.960	6.228	2.08	0.045
ProbSolv	4.0162	0.5393	7.45	0.000

$s = 11.09$        $R\text{-Sq} = 62.0\%$        $R\text{-Sq}(adj) = 60.9\%$

Calculate the 95% confidence interval of the slope of the regression line for all Applied Mathematics students.