

Statistics  
Mu Alpha Theta National Convention 2003

- For all questions, answer choice “E) NOTA” denotes “None Of These Answers”
  - Attached find (i) Z-distribution table and (ii) Student t-distribution table
- 1) Given a normal distribution centered at 17 with variance of 6, which of the following approximates the Z-score associated with the data point 11.5 to the nearest hundredth?
- A) -5.50      B) -2.25      C) -0.92      D) -0.15      E) NOTA
- 2) A cab driver wants to find the mean of his daily wages. Since he doesn't know the true mean, he is forced to take a sample. He finds, after 15 days of collecting data, that his sample mean is \$124 with a variance of \$90. Assuming his daily wages are normally distributed, what is the 99% confidence interval for his true mean daily wage? (Round your answer to the nearest penny.)
- A) (63.02,184.98)                      C) (117.57,130.43)                      E) NOTA  
B) (116.71,131.29)                      D) (117.69,130.31)
- 3) Given a 99% confidence interval from A to B based on a sample size Q, which of the following is a correct interpretation?
- A) 99% of the sample means of size  $\sqrt{Q}$  will fall between A and B.  
B) This sampling process is 99% effective in finding the true population mean.  
C) If this sampling process was repeated a large number of times, the resulting confidence intervals would actually contain the population mean 99% of the time.  
D) More than one of answer choices A, B, C is correct.  
E) NOTA
- 4) Given the following:  $P(A) = 0.65$ ,  $P(B) = 0.2$ ,  $P(A|B) = 0.5$ , find  $P(B|A)$  to the nearest hundredth.
- A) 0.15      B) 0.26      C) 0.62      D) 0.95      E) NOTA
- 5) Byron and Jimmy are in a racing league; Byron races drag cars while Jimmy races street trucks. They are trying to decide who performed better in this weekend's tournament. In Jimmy's category, the mean finish time was 195 seconds with variance 58 seconds. In Byron's category, the mean finish time was 17 seconds with variance 8 seconds. Jimmy finished in 170 seconds while Byron finished in 13 seconds. Assuming that the goal of the race is to finish first (e.g. fastest time) and both race finish times are normally distributed, who performed better in the tournament? (Disregard any differences in race difficulty, track conditions, or any other extraneous variables)
- A) Jimmy                                      C) They performed equally.                      E) NOTA  
B) Byron                                      D) Not enough information to answer this question.



**Use the following paragraph/information to answer questions 12 and 13**

Western Salt Company advertises and labels its bags of salt as 10 pounds. However, a separate consumer advocacy group believes that this is false advertising. They believe the true weight of the bags is significantly less than the advertised 10 pounds. In order to test this hypothesis, the FDA has ordered a statistical sample and test. They collected 85 bags and found that the average of this sample was 9.2 pounds with a standard deviation of 1.50.

12) Which of the following presents the correct set of hypothesis to test the consumer advocacy group's claim?  
(Note:  $\mu$  represents the actual population average weight per bag,  $H_0$  a null hypothesis, and  $H_a$  an alternative hypothesis).

- A)  $H_0: \mu = 10, H_a: \mu < 10$                       C)  $H_0: \mu = 10, H_a: \mu \neq 10$                       E) NOTA  
B)  $H_0: \mu = 10, H_a: \mu > 10$                       D)  $H_0: \mu = 10, H_a: \mu = 9.2$

13) What is the absolute value of the test statistic for this statistical inference? (Round to the nearest tenth)

- A) 0.5                      B) 4.9                      C) 6.0                      D) 45.3                      E) NOTA

14) Assume that a statistical test yields a  $p$ -value  $< \alpha$  where  $\alpha$  is your predetermined statistical significance level. Which of the following is a correct and statistically sound conclusion?

- A) Accept the null hypothesis.  
B) Fail to reject the null hypothesis.  
C) Reject the null hypothesis.  
D) Reject the alternative hypothesis  
E) NOTA

15) A random variable,  $Z$ , is uniformly distribution between 0 and 50, inclusively (e.g.  $0 \leq Z \leq 50$ ). What is the probability that  $Z > 10$ ?

- A) 0.10                      B) 0.20                      C) 0.80                      D) 0.90                      E) NOTA

16) Which of the following correctly describes the concept of a Type II error?

- A) Failing to reject a true null hypothesis  
B) Rejecting a true null hypothesis.  
C) Failing to reject a false null hypothesis.  
D) Rejecting a false null hypothesis.  
E) NOTA

17) Rocky Mountain Shipping receives an order of 50 lawnmowers which contains 1 defective mower. What is the probability that Hank Hill buys 10 mowers and finds that one of his is defective? (Round your answer to the nearest hundredth).

- A) 0.02                      B) 0.10                      C) 0.24                      D) 0.76                      E) NOTA

18) Which of the following is true of a right-skewed distribution?

- A) mode  $<$  mean  $<$  median  
B) mode  $<$  median  $<$  mean  
C) mean  $<$  median  $<$  mode  
D) There is not enough information to make an accurate determination.  
E) NOTA

19) Indian River County crime records show that 20% of all crimes are violent and 80% are nonviolent (including theft, forgery, etc). Ninety percent of violent crimes are reported versus 70% of nonviolent crimes. If a crime in progress is reported to the police, what is the probability that the crime is violent? (Round your answer to the nearest thousandth).

- A) 0.027                      B) 0.102                      C) 0.123                      D) 0.243                      E) NOTA

20) Among the 14 applications for a job, 10 have college degrees. If three of the applicants are randomly chosen to be interviewed, what is the probability that at least one of them has a college degree? (Round your answer to the nearest thousandth.)

- A) 0.011                      B) 0.330                      C) 0.670                      D) 0.989                      E) NOTA

**Use the following paragraph/information to answer questions 21, 22, and 23**

An investigation of traffic accident data revealed the following probability structure relating the extent of injury to the driver and the age of the driver. (Round all your answers to 21, 22, and 23 to the nearest hundredth).

	No injury	Injury	Fatality/death
Young	0.33	0.05	0.02
Middle-aged	0.17	0.02	0.01
Old/elderly	0.19	0.18	0.03

21) Suppose one of these accidents is selected at random. What is the probability that the driver was killed?

- A) 0.03                      B) 0.06                      C) 0.69                      D) 0.94                      E) NOTA

22) If the accident involved a driver who was not old, what is the probability of no injury?

- A) 0.17                      B) 0.57                      C) 0.63                      D) 0.83                      E) NOTA

23) A sample of 100 accidents is taken, yielding similar accident information. A Chi-squared test is performed yielding a test statistic,  $\chi^2$ , of 15.428 with an accompanying  $p$ -value of 0.00389. Which of the following is a correct and statistically sound conclusion (for any reasonable choice of  $\alpha$ )?

- A) The age and injury factors are independent.  
 B) The age and injury factors are not independent.  
 C) Decreased age causes an increase in death rates for accidents.  
 D) Only the “middle-aged” category and the “injury” category are dependant, others are independent.  
 E) NOTA

24) A certain company produces widgets. It is known that 80% of widgets produced by this company have no defects, 15% have exactly one defect, and 5% have more than one defect. If ten of these items are selected at random, find the probability that 8 have no defects and 2 have exactly 1 defect. (Round to the nearest hundredth).

- A) 0.01                      B) 0.15                      C) 0.17                      D) 0.19                      E) NOTA

25) Among 80 fish caught in a certain lake, 28 were inedible as a result of the chemical pollution of their environment. Find a 99% confidence interval for the proportion of fish in the entire lake that are inedible. (Round to the nearest hundredth.)

- A) (0.21 , 0.49)                      B) (0.25 , 0.45)                      C) (0.33 , 0.37)                      D) (0.34 , 0.36)                      E) NOTA

- 26) Research shows that 30% of all women taking a certain medication do not respond favorably. Find the probability that among nine randomly selected women taking the medication at least eight will respond favorably? (Round to the nearest thousandth).
- A) 0.001                  B) 0.156                  C) 0.196                  D) 0.804                  E) NOTA
- 27) People enter Moe's Tavern at an average rate of one person every two minutes (*HINT*: Poisson Distribution). What is the probability that at least four people enter the tavern between 2:00pm and 2:05pm? (Round to the nearest hundredth.)
- A) 0.12                  B) 0.24                  C) 0.76                  D) 0.88                  E) NOTA
- 28) A study on airline travel was conducted and found the following information: of the travelers arriving at a small airport, 60% fly on major airlines, 30% fly on privately owned planes and the remainder fly on commercially owned planes not belonging to a major airline. Of those traveling on major airlines, 50% are traveling for business reasons, whereas 60% of those arriving on private planes and 90% of those arriving on other commercially owned planes are traveling for business reasons. Suppose that the FAA randomly selects a passenger for extra security screening. What is the probability that this person arrived on a privately owned plane, given that this person is traveling for business reasons? (Round to the nearest thousandth.)
- A) 0.316                  B) 0.428                  C) 0.572                  D) 0.684                  E) NOTA
- 29) A company that manufactures automobile batteries has found that the life length of their standard battery has a normal distribution with a mean of 48 months and a standard deviation of 9 months. What should the warranty period be for this battery if the company wants to have to replace only 1% of the batteries that they sell? (Round your answer to the nearest month).
- A) 25                  B) 26                  C) 27                  D) 28                  E) NOTA
- 30) Which of the following is/are conditions of a binomial experiment?
- I) There are  $n$  identical trials.  
II) Each trial has  $k$  possible outcomes such that  $k > 2$   
III) The probability or outcome of one trial does not affect the outcome of another trial.
- A) I only                  B) III only                  C) II only                  D) I & III only                  E) NOTA