INSTRUCTIONS:
Write your name, lab section #, and ID# above. Note the statement at the bottom of this page that you must sign when you are finished with the exam.

Supply the following information on SIDE ONE of the scantron sheet:

⇒ Enter your name (last name first!) in the "name" section; no nicknames! FILL IN THE BUBBLES.
⇒ Enter your 3 digit lab section number in the "special code" section. FILL IN THE BUBBLES.
⇒ Enter your student ID number in the "identification number" section. FILL IN THE BUBBLES.
⇒ IMPORTANT! Enter the version number (either "1", "2"or "3") of your copy of the exam in the section marked "GRADE OR EDUCATION". The version number of this test is 1. BUBBLE IN THIS NUMBER!

There are 19 multiple choice questions. On the test circle the letter that corresponds to the answer you select. Also indicate your selection on the opscan sheet. Use a #2 pencil!

● For each wrong answer 5 points will be subtracted from 100.

● When you are finished: separate your scantron sheet from the test!
  i) place the 1st page of your test in the proper lab section stack on the auditorium stage.
  ii) place your scantron sheet in the folder labeled with your version of the test.

GOOD LUCK!!
Statement of academic honesty:
I have neither given assistance to another student nor received assistance from another student while taking this exam.

Signed ________________________
1. A survey of 296 recent deliveries by Fumble Express shows that 131 were delayed. The 95% confidence interval for the proportion \( p \) of delayed deliveries by Fumble Express is
   a. (109, 153)     b. (.386, .499)     c. (.368, .517)     d. (.326, .559)

2. If \( z \) is the standard normal random variable, what is \( P(.47 \leq z \leq 1.82) \)?
   a. .6464     b. .4609     c. .2884     d. .2848     e. 1.35

3. Which of the following is a correct statement concerning the Central Limit Theorem (CLT)?
   a. The CLT states that the sample mean \( \bar{x} \) is always equal to \( \mu \).
   b. The CLT states that for large samples, the sampling distribution of the sample mean \( \bar{x} \) is approximately normal.
   c. The CLT states that for large samples, the sample mean \( \bar{x} \) is equal to \( \mu \).
   d. The CLT states that for large samples, the sampling distribution of the population mean is approximately normal.
   e. The CLT states that for large samples, the standard deviation of the sample mean \( \bar{x} \) is approximately normal.

4. The third quartile of the probability distribution for a continuous random variable is the number with area .75 to its left under the probability density curve of the distribution. Which one of the following numbers is closest to the third quartile of the standard normal distribution?
   a. 1.0      b. 0.75   c. 0.2734      d. 0.675     e. −0.675

5. After calculating the sample size needed to estimate a population proportion to within 0.05, you have been told that the maximum allowable error must be reduced by half to just 0.025. If the original calculation led to a sample size of 1,000, the sample size will now have to be:
   a. 1,000       b. 2,000       c. 4,000       d. 8,000       e. 500

6. Suppose that the distribution of men's heights can be approximated by a normal model with a mean of 69 inches and a standard deviation of 4 inches. Then the probability that a man is shorter than 67 inches is
   a. .1915     b. .4772     c. .0228     d. .3085     e. .2123

7. The distribution of the amount of laundry detergent automatically dispensed into the boxes of a particular brand can be approximated by a normal model with a mean of 48 ounces and a standard deviation of 3 ounces. The percentage of boxes that contain less than 48 ounces is
   a. 50%     b. 0%   c. 68%     d. 95%     e. 75%

8. If a sample of size \( n = 25 \) is drawn from a population with standard deviation \( \sigma = 4 \), then the standard deviation \( SD(\bar{x}) \) of the sampling distribution of the sample mean \( \bar{x} \) is
   a. 12.5     b. 0.8   c. 0.16     d. 100     e. answer depends on the value of the population mean \( \mu \)

9. A sample of size \( n = 64 \) is drawn from a population with mean \( \mu = 30 \) and standard deviation \( \sigma = 12 \). What is the probability that the sample mean \( \bar{x} \) is at least 34?
   a. .4247     b. .0753     c. .0038     d. .4962     e. not enough information given
10. A sample of size \( n = 169 \) is drawn from a population with a skewed distribution that has mean \( \mu = 30 \) and standard deviation \( \sigma = 36 \). The sampling distribution model of the sample mean \( \bar{x} \) is approximately normal because
   a. the standard deviation is larger than 30
   b. the Central Limit Theorem applies in this situation
   c. the population mean \( \mu \) is normal
   d. since \( n \) is so large, the sample mean \( \bar{x} \) can be considered equal to the population mean \( \mu \)
   e. a and c are both correct

11. Coors Field in Denver Colorado is the home ballpark of the Colorado Rockies, a major league baseball team. The elevation of Coors Field is approximately 1 mile above sea level, much higher than any other ballpark in major league baseball. Because of its elevation, Coors Field has always been regarded as a home run friendly ballpark; a batted ball travels approximately 10% farther at Coors Field than at a ballpark at sea level. The Rockies were aware of this when Coors Field was built in 1995 so the field was designed to make it more difficult to hit a home run, but home runs still were hit at Coors Field at a much higher rate than at any other ballpark.

In an attempt to compensate for the extra distance that batted balls travel, in 2002 the Rockies began humidifying the baseballs. They keep them in a room where the temperature is 70 degrees and the humidity is 50%, conditions that are similar to those at ballparks at sea level. The idea is that the humidity will make the baseballs slightly larger and softer, so they would not fly as far.

Has humidifying the baseballs helped? Here is the data: between 2002 and 2008 the number of home runs hit in all games at Coors Field (Rockies' home games) is 1,380; the number of home runs hit in all Rockies' away games is 1,178. What is the approximate P-value of the hypothesis test,

\[ H_0 : p = 0.5, \quad H_A : p > 0.5, \]

where \( p \) is the proportion of all home runs hit in Rockies' home and away games that are hit at Coors Field?

a. 0.05       b. 3.94       c. 0       d. .539       e. 1

Use the following information to answer questions 12 and 13:

A popular Web site among college students is studentinfo.com. It lists information about jobs both in the United States and abroad. The management of the Web site claims that 50% of all college students know about the Web site.

12. From a sample of 100 students you calculate the sample proportion \( \hat{p} \) who have heard of the Web site studentinfo.com. If the claim by management is correct, what is \( \sigma_{\hat{p}} \), the standard deviation of the sampling distribution of the sample proportion \( \hat{p} \)?

a. .0025       b. .25       c. 25       d. .05       e. 2.5

13. In a sample of 100 students what is the probability that the sample proportion \( \hat{p} \) who have heard of the Web site studentinfo.com is less than 0.45?

a. 0.45       b. 0.1587       c. 0.3413       d. .6587       e. 0.8413

14. A random sample of size 576 is to be taken from a population with mean 85 and standard deviation 36. The sample mean of the observations in our sample is to be computed. The sampling distribution model of the sample mean \( \bar{x} \) is

a. normal with mean 85 and standard deviation 36.
   b. normal with mean 85 and standard deviation 6.
   c. normal with mean 85 and standard deviation 1.5.
   d. normal with mean 17.35 and standard deviation 6.

15. GMAT scores for a recent exam at a university can be modeled with a normal distribution that has mean 1000 and standard deviation 75. The university wanted to classify the lower 12.3% of scores as “not acceptable” for admission. At what score should the university set the cutoff?

a. 877       b. 1087       c. 913       d. 991       e. 1023
16. An article in *Parenting* magazine (Dec/Jan 2004) reported that 60% of Americans surveyed say that they need a vacation after visiting family for the holidays. Suppose the true proportion of all Americans who need a vacation after visiting family for the holidays is indeed 60%. A simple random sample of 150 Americans is selected and the sample proportion \( \hat{p} \) of those who say they need a vacation after visiting family for the holidays is computed. The sampling distribution model of the sample proportion \( \hat{p} \) is

a. normal with mean .60 and standard deviation .04  
b. normal with mean .60 and standard deviation .16  
c. normal with mean .60 and standard deviation .0016  
d. binomial with mean .60 and standard deviation 6  
e. binomial with mean .60 and standard deviation 36

17. (True or false) In a test of significance, a \( P \)-value of 0.03 means that there is only probability 0.03 that the null hypothesis is true.

18. *Dewey, Lie, and Howe* is a national company that sells cell phones. Company management is interested in estimating \( p \), the proportion of customer sales transactions in which the customer is convinced to purchase more expensive, but useless, cell phone upgrades. A random sample of customer sales transactions results in a 95% confidence interval of \( .73 \pm .06 \) for \( p \). What choice below correctly describes this confidence interval?

a. On 95% of days, between .67 and .79 of customer sales transactions result in purchases of more expensive but useless upgrades.  
b. 95% of the company's salespersons can convince customers to purchase more expensive but useless upgrades in between .67 and .79 of their transactions.  
c. The probability is .95 that the true proportion \( p \) of sales transactions that result in purchases of more expensive but useless upgrades is between .67 and .79  
d. 95% of all random samples of customer sales transactions will show that .73 of customer sales transactions result in purchases of more expensive but useless upgrades.  
e. We are 95% confident that the interval \( (.67, .79) \) contains the true, but unknown, proportion \( p \) of all customer sales transactions that result in purchases of more expensive but useless upgrades.

19. A \( P \)-value is the probability:

a. that the null hypothesis \( H_0 \) is true  
b. that we have made the wrong conclusion when doing the hypothesis test  
c. calculated under the assumption that the null hypothesis \( H_0 \) is true, that the test statistic would assume a value as or more extreme than the value stated in the null hypothesis  
d. calculated under the assumption that the null hypothesis \( H_0 \) is true, that the test statistic would assume a value as or more extreme than the observed value of the test statistic.  
e. that the null hypothesis \( H_0 \) is in fact false.

20. An online book seller is concerned about the timeliness of the delivery of their books. The VP of Operations and Marketing recently stated that she wanted the percentage of book orders delivered on time to be at least 90%, and she wants to know if the company has succeeded. Let \( p \) be the proportion of book orders that are delivered on time. Choose the correct null and alternative hypotheses below.

a. \( H_0 : p = .90, H_a : p < .90 \)  
b. \( H_0 : p = .90, H_a : p \neq .90 \)  
c. \( H_0 : \hat{p} = .90, H_a : \hat{p} > .90 \)  
d. \( H_0 : p > .90, H_a : p = .90 \)  
e. \( H_0 : p = .90, H_a : p > .90 \)  
f. \( H_0 : \hat{p} = .90, H_a : \hat{p} \neq .90 \)
Use the following information for question 21-24

A consumer research organization poll asked consumers if they trusted "eco friendly" labels on cleaning products. Out of 1000 adults surveyed, 498 responded "yes." We would like to test if the proportion $p$ of consumers that trust these labels is more than 50%. The null hypothesis is $H_0: p = .50$.

21. The correct alternative hypothesis $H_A$ is
   a. $H_A: p = .50$     b. $H_A: \hat{p} \geq .50$      c. $H_A: p \geq .50$    d. $H_A: \hat{p} > .50$    e. $H_A: p > .50$

22. The value of the test statistic $z$ is
   a. $-0.126$   b. $-2.45$    c. $0.498$    d. $-1.89$    e. $0.139$

23. If the value of the test statistic above is denoted as $z_0$, then the correct calculation of the $P - value$ is
   a. $P(z < z_0)$   b. $P(z > z_0)$    c. $2P(z > |z_0|)$    d. $1 - P(z > z_0)$    e. $1 - P(z < z_0)$
24. Suppose the $P$-value is 0.550. Then the correct conclusion is
   a. Since the $P$-value is greater than .05, do not reject the null hypothesis. There is insufficient
evidence to conclude that the proportion of consumers that trust “eco-friendly” labels differs from
.50
   b. Since the $P$-value is greater than .05, reject the null hypothesis. There is sufficient evidence to
conclude that the proportion of consumers that trust “eco-friendly” labels is greater than .50
   c. We cannot conclude anything from the hypothesis test because there is a 0.550 chance that we have
made an error.
   d. Since there is only a 0.550 chance that $H_0 : p = .50$ is true, we have to reject $H_0$.
   e. Since 0.550 is the probability the alternative hypothesis $H_A$ is true, we should reject $H_0$.

**ANSWERS**

11. c. $\hat{p} = \frac{1380}{1390 + 1178} = .539$; $SD(\hat{p}) = \sqrt{\frac{(0.5)(0.5)}{2568}} = 0.0099$; test statistic $z = \frac{0.539 - 0.5}{0.0099} = 3.94$;
   $P$-value = $P(z > 3.94) = 0$ (from $z$ table) or $P$-value = $P(z > 3.94) = 4.07E - 05$ (from Excel).
   Since the $P$-value is less than 0.05, we reject $H_0 : p = 0.5$ and conclude $p > 0.5$, that is, Coors Field is
   still a home run friendly ballpark even though the baseballs are humidified.