Would you like your course grade posted by student number on Tuesday, December 22, on the east side of the Mathematical Sciences Building (on the glass facing the student recreation center)?

Yes  No

Instructions:
*** DO NOT make any marks in the grading area (right margin.) ***

I. For Full-work problems, all work must be shown in order to receive credit. Your final answers should be clearly written in the blanks provided or, if no blank is provided, circled.

II. Carry all computations to at least three decimal places unless otherwise indicated.

III. Multiple-choice questions are worth 2 points each; point values are noted next to each full-work problem. The entire exam is worth 150 points and counts for 30% of your course grade.

IV. For hypothesis tests you must: Clearly state $H_0$ and $H_A$; Show the computation of the test statistic; Indicate the rejection region by drawing a picture and labeling the critical value (or by computing a $p$-value); and Clearly indicate your conclusion.

V. You may make any assumptions which are necessary to work the problems using the methods we have developed in class. However, you should not make any assumptions beyond what is necessary.
1. (14 points.) A firm has determined that the two configurations of its assembly line produce, on average, approximately the same number of finished units per day. To obtain greater process control, it has been suggested that the configuration with the smallest variance be permanently adopted. Two independent random samples produced the following results:

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Sample mean</th>
<th>Sample variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration #1</td>
<td>21</td>
<td>85</td>
</tr>
<tr>
<td>Configuration #2</td>
<td>21</td>
<td>87</td>
</tr>
</tbody>
</table>

Conduct a test at the .05 level of significance to determine if the variance in units produced for configuration #1 is less than the variance in number of units produced for configuration #2.

\[ H_0: \text{_____________} \quad \text{vs.} \quad H_A: \text{_____________} \]

Supporting work:

Should \( H_0 \) be rejected? (circle one): Yes No
2. The manufacturer of an over-the-counter pain reliever claims that its product brings pain relief to headache sufferers in less than 3.5 minutes, on average. Using data from a random sample of 50 headache sufferers, the company will test \( H_0 : \mu = 3.5 \) vs. \( H_A : \mu < 3.5 \) at the .05 level of significance. Assume that \( \sigma = 1 \) minute.

(a) (7 points.) Write the rejection rule in terms of \( \bar{x} \):

Reject \( H_0 \) if \( \bar{x} < \) ________________.

(b) (7 points.) REGARDLESS OF WHAT YOU ACTUALLY GOT, suppose your answer to (a) had been: "Reject \( H_0 \) if \( \bar{x} < 3.1 \)." Use this rule to determine the probability that the test will commit a type II error when \( \mu = 3.4 \) minutes.

3. (14 points.) A soda machine dispenses soda into plastic bottles. The amount of soda dispensed by the machine is normal with a mean of 12 ounces and a standard deviation of .2 ounces. The machine will dispense at least ________________ ounces of soda into a bottle 98.5\% of the time.
4. (14 points.) An automobile manufacturer has determined that 30% of all gas tanks that were installed in its 1993 model are defective. If 45 of these cars are selected at random, what is the probability that more than 20 will have defective gas tanks? Use the normal distribution as an approximation and make the continuity correction. (You need not verify that the requirements for using the approximation are satisfied.)

5. Of members at a local country club, 70% regularly use the golf course, 50% regularly use the tennis courts, and 30% regularly use the golf course and the tennis courts.

(a) (7 points.) If a member is selected a random, what is the probability that he or she does NOT regularly use either of these facilities?

(b) (7 points.) Are the events "the selected person regularly uses the golf course" and "the selected person regularly uses the tennis courts" independent? Show why or why not.
6. In order to attract more business travelers, hotels are offering more amenities. A survey showed that 70% of American hotels now offer hairdryers in their rooms, and 32% offer in-room internet access. Suppose that 20 hotels are selected at random.

(a) (7 points.) What is the probability that at least 15 of them will offer hairdryers?

(b) (7 points.) What is the probability that exactly 6 of them will offer internet access?

7. (14 points.) On any given work day, the amount of time that managers at a large corporation spend doing paperwork is thought to have a right-skewed distribution with a mean of 2.7 hours and a standard deviation of 1.4 hours. What is the probability that a random sample of 75 managers will average between 2.5 and 3.2 hours of time doing paperwork on the third work day of next month?
8. The Environmental Protection Agency (EPA) estimated that the 1991 Saturn automobile, on average, travels 35 miles per gallon of gasoline during highway driving. Saturn believes that its mileage exceeds the EPA claim. To support its position, Saturn randomly selected 36 of its 1991 model line and tested the cars on a test track similar to the one used by the EPA. The results show that the cars average 36.8 miles per gallon with a standard deviation of 5 miles per gallon.

(a) (3 points.) In this problem, Saturn is testing

\[ H_0 : \text{_________________________} \quad \text{vs.} \quad H_A : \text{_________________________} \]

(b) (8 points.) Compute the p-value of the test.

(c) (3 points.) For \( \alpha = .05 \), should \( H_0 \) be rejected? Circle one: Yes No

9. At U. S. universities and colleges, 55% of students are female. If samples of \( n = 2,475 \) students are considered, the standard error of the sampling distribution of \( \hat{p} \) (the sample proportion of female students) is

(A) .00001;  
(B) .0001;  
(C) .001;  
(D) .01;  
(E) None of the above choices represent a suitable response.

9. ANSWER: __________

10. Suppose you want to estimate the difference between two population proportions correct to within .05 with 95% confidence. Both \( p_1 \) and \( p_2 \) are believed to be near .3, and equal sample sizes are desired. The required minimum sample sizes are

(A) \( n_1 = n_2 = 228; \)  
(B) \( n_1 = n_2 = 277; \)  
(C) \( n_1 = n_2 = 455; \)  
(D) \( n_1 = n_2 = 646; \)  
(E) None of the above choices represent a suitable response.

10. ANSWER: __________
11. According to Business Week magazine, the starting salaries of female MBA graduates have a mean of $54,749, a standard deviation of $10,250, and a median of $47,543. Based on this information, the distribution of female MBA graduates appears to be
(A) skewed to the right;
(B) skewed to the left;
(C) symmetric;  
11. ANSWER: __________
(D) mound-shaped;
(E) None of the above choices represent a suitable response.

12. A discrete random variable has the following probability distribution:

<table>
<thead>
<tr>
<th>x</th>
<th>p(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.1</td>
</tr>
<tr>
<td>5</td>
<td>.6</td>
</tr>
<tr>
<td>10</td>
<td>.1</td>
</tr>
<tr>
<td>20</td>
<td>.2</td>
</tr>
</tbody>
</table>

The expected value of the random variable is
(A) 5.0;
(B) 9.0;
(C) 10.0;  
12. ANSWER: __________
(D) 20.0;
(E) None of the above choices represent a suitable response.

13. The top speeds for a sample of three new automobile brands are as follows:
100, 125, 150.
The mean is 125. The standard deviation is (to the nearest integer)
(A) less than 30;
(B) between 30 and 100;
(C) between 101 and 200; 
13. ANSWER: __________
(D) between 201 and 500;
(E) more than 500.

14. If events $A$ and $B$ are independent with $P(A) = .6$ and $P(B) = .4$ then
(A) $P(A \cap B) = .20$;
(B) $P(A \cup B) = .76$;
(C) $P(A \cap B) = 1.00$;  
14. ANSWER: __________
(D) $P(A \cup B) = .24$;
(E) $P(A \cap B) = 0.00$. 

7 of 10
15. Of 20 applicants for a job, 15 are female and 5 are male. If the two applicants are selected at random to be interviewed, what is the probability that both interviews will be granted to men? (Round your answer to 4 decimal places.)

(A) .3947;
(B) .0526;
(C) .4473;  
(D) .5527;
(E) .9474.

15. ANSWER: __________

16. A sample of 320 union members showed their missed work time due to illness during the past month averaged 9.6 hours with a standard deviation of 6.4 hours. A 90% confidence interval for the true mean number of hours or work union members missed last month due to illness is

(A) 9.6 ± (1.96)\left(\frac{6.4}{\sqrt{320}}\right);
(B) 9.6 ± (1.96)(6.4);
(C) 9.6 ± (1.645)\left(\frac{6.4}{\sqrt{320}}\right);  
(D) 9.6 ± (1.645)(6.4);
(E) None of the above choices represent a suitable response.

16. ANSWER: __________

17. If an hypothesis test rejects $H_0$ at $\alpha = .10$, then

(A) a type I error has been committed;
(B) a type II error has been committed;
(C) p-value < .10;  
(D) both (A) and (B);
(E) None of the above choices represent a suitable response.

17. ANSWER: __________

18. The weight of a manufactured product has a probability distribution with a mean of 6 ounces and a standard deviation of 2.5 ounces. Which of the following statements is true regarding the sampling distribution of $\bar{x}$ for samples of size $n = 15$?

(A) The mean of the sampling distribution is 6 ounces;
(B) The standard deviation of the sampling distribution is 2.5 ounces;
(C) The form of the sampling distribution is approximately normal;  
(D) both (A) and (B);
(E) None of the above choices represent a suitable response.

18. ANSWER: __________
19. A population has a mean of 25. If 100 samples are selected from this population and each one is used to form a 95% confidence interval for $\mu$, how many of these intervals would you expect to contain 25?

(A) 100;
(B) 95;
(C) 90;
(D) 25;
(E) None of the above choices represent a suitable response.

20. A random variable is uniformly distributed between 0 and 100. Its mean is

(A) 0;
(B) 100;
(C) 49.5;
(D) 50.5;
(E) None of the above choices represent a suitable response.

21. A random variable is uniformly distributed between 0 and 60. Its variance is

(A) 0;
(B) 5;
(C) 25;
(D) 300;
(E) None of the above choices represent a suitable response.

22. Two events are such that $P(A) = .7$, $P(B) = .5$, and $P(A \cap B) = .30$. Events $A$ and $B$ are

(A) independent;
(B) mutually exclusive;
(C) dependent;
(D) complementary;
(E) None of the above choices represent a suitable response.

23. Ages of five students are: 26, 17, 16, 30, and 21. The median age is

(A) 16;
(B) 22;
(C) 26;
(D) 5;
(E) None of the above choices represent a suitable response.
24. A population has a mean of 50 and a standard deviation of 3. At least 75% of the values in the population must be between

(A) 47 and 53;
(B) 44 and 56;
(C) 44 and 53;  
24. ANSWER: __________
(D) 47 and 50;
(E) None of the above choices represent a suitable response.

25. In a sample with a mean of 100 and a standard deviation of 10, the proportion of measurements between 70 and 130 is (rounded to three decimal places)

(A) approximately .997;
(B) at least .889;
(C) at least .750;  
25. ANSWER: __________
(D) approximately .950;
(E) None of the above choices represent a suitable response.

26. If the values in a dataset follow a mound-shaped distribution with a mean of 20 and a standard deviation of 5, the percentage of values that are larger than 30 is approximately

(A) 5%;
(B) 95%;
(C) 2.5%;  
26. ANSWER: __________
(D) 68%;
(E) None of the above choices represent a suitable response.

27. If the values in a dataset follow a mound-shaped distribution with a mean of 20 and a standard deviation of 5 then approximately 68% of the values will be between

(A) 5 and 35;
(B) 10 and 30;
(C) 15 and 25;  
27. ANSWER: __________
(D) 0 and 40;
(E) None of the above choices represent a suitable response.