UNIVERSITY of VIRGINIA	**NAME:**_____ **STAT 2120: Introduction to Statistical Analysis** Fall 2011

Midterm Exam II, November 17, 2011

This exam is closed book and closed notes, but you are allowed to use the formula sheet that is provided for you. You may use a calculator but not your laptop computer. All cell phones, ipods, and other electronic devices must be turned off. You are not permitted to work in groups or discuss the exam with anyone. The work you submit must be your own.

Please fill out your identifying information on the top of the scantron form now. On the right side of your form, write and carefully bubble your UVA computing ID (the front part of your UVA email address, *i.e.*, djs4y) in the space provided. Left justify your computing ID (*i.e.*, leave space to the right). For each question, completely fill in the label of your answer in the corresponding space on the accompanying scantron form. Each question is designed to have a single correct answer. If it seems that more than one statement is correct, then you should select the statement that best answers the question. If you calculate a numerical answer, but its exact value is not listed as a choice of answer then you should select the listed value that is closest to yours. Also, if the question asks for a probability but states that a "good approximation" is acceptable, then you should assume the context is such that any relevant approximation formula is valid (*e.g.*, the sample size is large enough for validity of the central limit theorem).

Some problems may require an evaluation of one of the Excel functions: **normsdist, normsinv, tdist, tinv, chidist, chiinv**. For these you should refer to the list of selected evaluations of those functions that is provided with the exam.

Print your name clearly above, sign the honor pledge below, and write out this honor pledge on the space provided on the back of the scantron form. You have 90 minutes to complete the exam. There are twenty-eight questions on the exam. Each counts the same amount toward your final score.

Honor Pledge:
I have neither given nor received unauthorized aid on this exam.

Signed: _____

1) A statistician is analyzing a random sample of 87 measurements from a Normal population with a standard deviation of 73. The mean of the sample is observed at 178, and the statistician reports a confidence interval of 178 ± 16 = (162, 194). What is the confidence level associated with this interval?

a. 0.90
b. 0.95
c. 0.96
d. 0.98

2) A researcher collected data on 24 houses that were selected by simple random sampling from all of the houses in a certain city. The average value of the houses in the sample is calculated to be $182.4K. Calculate an approximate 95% confidence interval for the mean value of houses in the city. Assume the standard deviation of the value of houses in the city is $80.0K.

a. (25.6, 339.2)
b. (150.4, 214.4)
c. (155.5, 209.3)
d. (146.8, 218.0)

3) Among a certain population of business firms, suppose the distribution of the firms' ages has a standard deviation of 21 years. In planning survey to estimate the mean age of the firms in the population, it is of interest to produce a 95.6% confidence interval with a margin of error less than 4. What sample size is needed to achieve this objective?

a. 80
b. 81
c. 111
d. 112

4) Consider a test of the hypotheses

$$H_0: \mu = 150 \text{ versus } H_a: \mu \neq 150$$

based on a random sample of $n = 80$ from a population that is Normal with standard deviation $\sigma = 115$. If the mean of the sample is $\bar{x} = 170$, what is the corresponding P-value for the test?

a. 0.060
b. 0.120
c. 0.174
d. 0.431

5) Suppose a gambler believes that a certain coin is fair, and thus lands "heads" with probability 0.5 on each flip. The gambler decides that his impression of the fairness of the coin will change if, and only if, he observes at least five "heads" in the next six independent flips of the coin. Supposing that the coin is indeed fair, what is the probability that the gambler's impression of the fairness of the coin will change?

a. 0.016
b. 0.094
c. 0.109
d. 0.219

6) Refer to the setup of Problem 5. Suppose that the coin is not fair, but the true probability of "heads" is 0.8. What is the probability that the gambler's impression of the fairness of the coin will change?

a. 0.262
b. 0.393
c. 0.655
d. 0.657

7) In planning a study, whose results will be reported as a one-sample z confidence interval, what factor increase in sample size would lead the margin of error to be reduced to 1/4 of its original size? (For instance, the factor 4 increases the number 3 to 4 × 3 = 12; the number (1/3) × 18 = 6 represents a decrease in the number 18 by the factor one third.)

a. (1/4) σ
b. (1/4) z^*
c. 4
d. 16

8) Which statement below reflects a correct interpretation of a confidence interval?

a. The formula used to calculate the upper and lower bounds of a 95% confidence interval for μ would, in the long run, yield an interval that includes μ 95% of the time
b. The formula used to calculate the upper and lower bounds of a 95% confidence interval for μ calibrates the population values so that their distribution is Normal
c. Given a 95% confidence interval for μ, the probability is 0.95 that μ is between the upper and lower bounds reported in the interval
d. Given a 95% confidence interval for μ, the probability is 0.95 that the mean, $\bar{x}$, of a new sample would fall between the upper and lower bounds reported in the interval

9) In a one-sample z test of H_0: $\mu = \mu_0$ *versus* H_a: $\mu > \mu_0$, which statement below describes data that would be considered extreme if observed when H_0 is true?

a. Data such that $\bar{x}$ is much larger than μ_0
b. Data such that $z = (\bar{x} - \mu_0) / \sigma_{\bar{x}}$ is much larger than zero
c. Data such that the probability that a standard normal random variable Z is greater than the calculated value of $z = (\bar{x} - \mu_0) / \sigma_{\bar{x}}$ is very small
d. All of the above

10) The power of a hypothesis test is the probability of:

a. An incorrect decision about H_0 when H_0 is false
b. An incorrect decision about H_0 when H_0 is true
c. A correct decision about H_0 when H_0 is false
d. A correct decision about H_0 when H_0 is true

11) Suppose that advertising for a certain brand is light in City 1, but heavy in City 2. In a marketing experiment, suppose that independent samples of city-residents are drawn from the two cities; each sampled resident is prompted to recall the name the brand, and then timed for how long his or her recollection takes. The experiment aims to establish that the mean recollection times across residents of the more heavily advertised city is smaller than that of the other city. Writing μ_1 and μ_2 for the respective mean recollection times of City 1 and City 2, which statement below correctly formulates the relevant comparison of hypotheses?

a. H_0: $\mu_1 = \mu_2$ *versus* H_a: $\mu_1 > \mu_2$
b. H_0: $\mu_1 < \mu_2$ *versus* H_a: $\mu_1 = \mu_2$
c. H_0: $\mu_1 = \mu_2$ *versus* H_a: $\mu_1 \neq \mu_2$
d. H_0: $\mu_1 < \mu_2$ *versus* H_a: $\mu_1 \neq \mu_2$

12) Suppose it is planned to test the hypotheses H_0: $\mu = 100$ *versus* H_a: $\mu < 100$ based on a simple random sample of $n = 36$ individuals drawn from a Normal population with standard deviation $\sigma = 64$. The test will be carried out using the one-sample z test with $\alpha = 0.05$. What is the power of the test when the mean is actually $\mu = 81$.

a. 0.090
b. 0.444
c. 0.556
d. 0.950