Pledge:

3/8/2007 MATH 271 Name:_____
Dr. Lunsford Midterm Exam 100 Points Possible

Please show all of your work on this exam paper. To achieve the maximal amount of credit, please show all calculator input. Good luck!

I. Multiple Choice, Matching, and True/False. For each multiple choice question below, circle the best answer. (Unless otherwise indicated, 3 points each - 15 points total)

1. True or False (circle one): In general, if we increase the level of confidence for a confidence interval then the length of the confidence interval will decrease.

2. Suppose you are conducting a z - test for a population mean μ with the hypotheses:

$$H_0 : \mu = \mu_0 \text{ and } H_1 : \mu > \mu_0$$

at the $\alpha = 0.035$ level, where μ_0 is a constant. If the data, i.e. $\bar{x}$, has a z -score of 1.635 then the p -value of the test (rounded to four decimal places) is:

(a) 0.0510 (b) 0.1020 (c) 0.0350 (d) 0.0255 (e) None of these

3. A test has 16 multiple choice questions each with 5 possible choices for the answer. A student guesses the answer to every question. Let the random variable X be the number of questions the student correctly guesses (i.e. gets right). Then X has a binomial distribution with parameters:

(a) $n = 16, p = 1/5$ (b) $n = 16, p = 5$ (c) $n = 5, p = 16$
(d) $n = 16, p = 4/5$ (e) None of these.

4. The Lectric Co. reports the mean lifetime, μ, of the battery packs they make is between 28.86 and 30.34 hours with 93% confidence. Please answer the following (3 points each, 6 total):

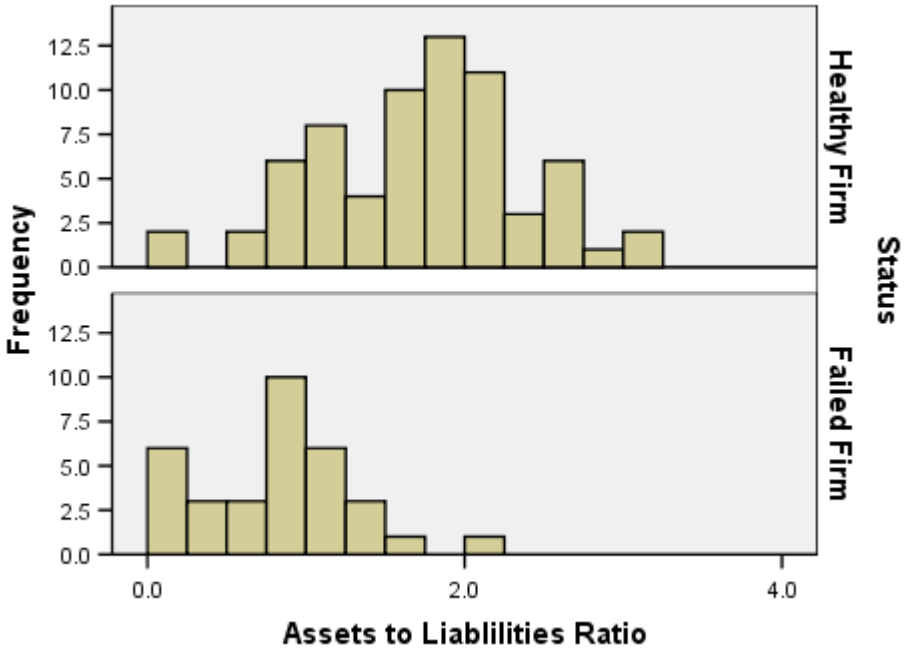
- What was the point estimate for μ used to compute this interval?_____
- What is the margin of error for the point estimate?_____

Problem II. In order to determine why some companies fail and others do not, researchers compared various characteristics of 68 randomly chosen healthy firms and 33 randomly chosen failed firms. One of the variables considered was the ratio of current assets to current liabilities (i.e. the amount the firm is worth divided by what it owes). Please answer the following questions: (4 points each, 24 point total)

(a) On the next page you are given histograms of the distribution of the *Assets to Liabilities Ratio* for *Healthy* and *Failed* firms. Which type of firm appears to have a larger mean *Assets to Liabilities Ratio*?

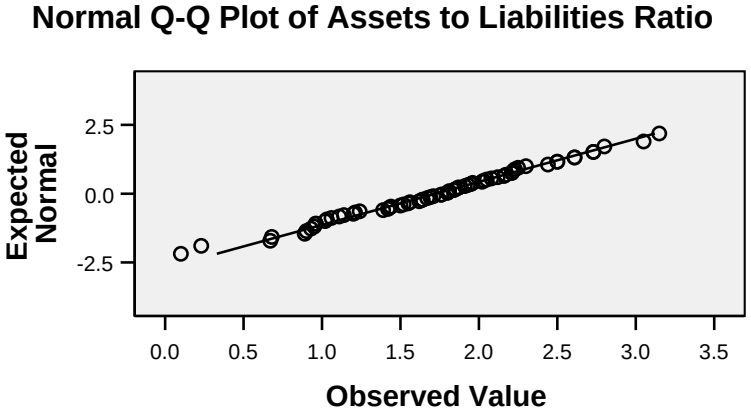
(b) Again using the histograms below, which type of firm appears to have a smaller standard deviation for the *Assets to Liabilities Ratio*?

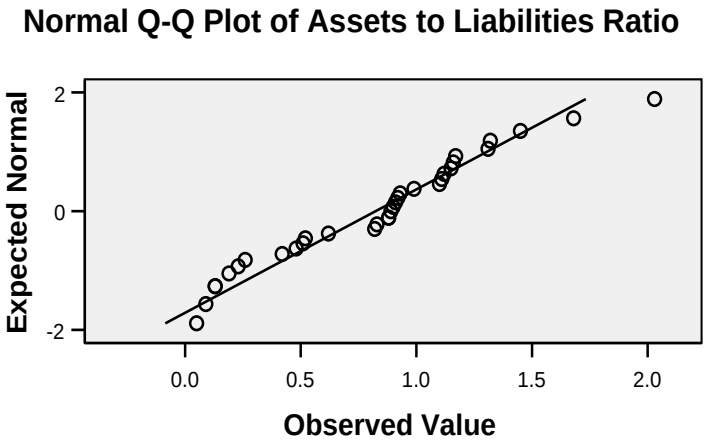
(c) A test of normality for the two types of firms is shown below. Based on this test, which (both, only one (which?), neither) type(s) of firm have *Assets to Liabilities Ratios* that are from a normal population? Justify your answer.



	Status	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Assets to Liablilities Ratio	Failed Firm	.133	33	.145	.959	33	.242
	Healthy Firm	.052	68	.200(*)	.991	68	.895

(d) Below you are given q-q plots of the distributions of assets to liabilities ratio for the two types of firms. Clearly indicate which plot belongs to which type of firm (i.e. failed or healthy).





Problem II, continued.

(e) Let μ_H be the mean *Assets to Liabilities Ratio* for healthy firms and and μ_F be the mean *Assets to Liabilities Ratio* for failed firms. Consider the following hypotheses:

$$H_0 : \mu_H = \mu_F \quad H_a : \mu_H > \mu_F$$

What statistical test would you need to use to test these hypotheses? What assumptions, if any, will you need to make about the distributions of the assets to liability ratios from each type of firm?

(f) The p-value for the test in part (e) above is 1.5×10^{-10}. What is your conclusion of the test in the context of this problem?

Problem III. A recent FOX News/Opinion Dynamics Poll (conducted on Dec. 5-6) asked 900 randomly chosen registered voters nationwide the following question, "Do you approve or disapprove of the job George W. Bush is doing as president?" Please answer the following questions: (4 point each, 12 points total)

(a) If 38% of those sampled approve, then find a 90% confidence interval for the true proportion of Americans that approve. Clearly indicate what type of interval you are finding, your calculator input, and the confidence interval.

(b) If the true percent of Americans that approve was actually 45%, then how many Americans in the sample would you expect, on average, to approve?

(c) Based on the confidence interval found in part (a), can a conservative talk show host on the radio reasonably claim that 45% of Americans approve of the job George W. Bush is doing at president? Why or why not?

Problem IV. The systolic blood pressure for a certain group of obese people has a mean of 132 and standard deviation of 8 (both in units of mmHg). Let the random variable X denote the blood pressure of a randomly selected individual from this group. Assume that X is normally distributed. Please answer the following. Also **please show all calculator input**. (14 points total)

(a) Draw the graph of the distribution of X. On the graph you should show values $\pm 1, \pm 2$, and ± 3 standard deviations from the mean. Clearly label your axis. (6 points)

(b) Find how likely it is for X to be at least 130 and show this probability on the graph above. (4 points)

(c) What is the lowest blood pressure a person from this group could have to be considered among the 10% of the group with the highest blood pressure? (4 points)

Problem V. Among the entire population of homeowners, the mean loss from fire is \$250.00 with a standard deviation of \$1000.00. The loss from fire by homeowners is not a normally distributed variable. Let $\bar{x}$ be the mean loss from fire for 100 randomly chosen homeowners. Please answer the following: (10 points total)

1. The standard deviation of $\bar{x}$ is: (circle one) (3 points)

(a) \$10.00 (b) \$1000.00 (c) \$100.00 (d) \$250

2. The sampling distribution of $\bar{x}$ is: (circle one) (3 points)

(a) Not normal but the same as the population distribution of the homeowners loss from fire.
(b) Approximately normal with mean \$250.00 and standard deviation \$100.00.
(c) Approximately normal with mean \$250.00 and standard deviation \$1000.00
(d) None of the above.

3. Would it be unusual for $\bar{x}$ to be greater than \$450.00? You must justify your answer by computing the probability $\Pr\left(\bar{x} > 450.00\right)$. (4 points)

Problem VI. A random sample of 35 assistant professors from a certain state has a mean salary of \$43,260 and a sample standard deviation of \$5430. Let μ be the average salary of all assistant professors in the state. Please answer the following. (5 points each, 25 points total)

(a) Find a 90% confidence interval for μ. Clearly indicate what type of interval you are finding (z or t for a population mean, z for a proportion, etc.) and why, what data values you enter into your calculator, and your answer.

(b) Write a complete English sentence that clearly describes your results in part (a).

(c) Conduct the hypotheses test $H_0 : \mu = 42000$ versus $H_a : \mu > 42000$ at the $\alpha = 0.05$ level of significance. You should clearly what test you are using and why, any assumptions you make in order to use the test, the value of the test statistic, the p-value of the test. Please show all calculator input.

(d) Draw a graphical representation of the test statistic and p-value you have found in part (c) above. Clearly label and show all relevant information on the graph.

(e) What is your conclusion of the test conducted in part (c) in the context of this problem?