Print Name:	Signature:
Section:	Instructor:
ID #:	

Directions: You have **110 minutes** to answer the following questions. ***You must show all your work*** as neatly and clearly as possible and indicate the final answer clearly. You may use only a TI-30 calculator.

If you are feeling ill you should inform the proctor. The proctor will note your name, student ID and accept any written statement(s) that you may wish to make regarding your illness. Cell phones and other electronic devices may **NOT** be used during the exam.

You should show your work for each problem and present your final answer either in a reduced fraction form or a decimal.

Problem	Possible	Points
1	20	
2	16	
3	16	
4	16	
5	16	
6	16	
Total	100	

Mathematics Department After-Test Survey:
"We care what you think!"

1. This exam was

    (a) too hard   (b) fair   (c) easy

2. This exam reflected the assigned homework/worksheet problems

    (a) a lot   (b) somewhat   (c) not much

3. The time I was given to complete this exam was

    (a) too much   (b) just right   (c) too little

(1) (a) Let $X_1, X_2, \ldots, X_{16}$ be a random sample from the normal distribution $N(90, 10^2)$. Let $\overline{X}$ be the sample mean and S^2 be the sample variance. Fill in each of the following blanks. Show your work.

   (i) $P(86 < X_1 < 94) = $ —————.

   (ii) $P(86 < \overline{X} < 94) = $—————.

   (iii) $P\left(S^2 \leq 166.64\right) = $—————.

(b) Assume that the nicotine content (in mg) in a cigarette approximately follows a normal distribution $N(\mu, 0.3^2)$. When using $\overline{X}$ to estimate μ, if we want to be 90% confident that our estimate is correct to within ± 0.03 mg, how large a sample is needed? (In other words, find the sample size required such that the maximum error is 0.03 mg at 90% confidence level.) Show your work.

(2) Suppose the FAA weighed a random sample of 20 airline passengers during the summer and found their weights to have a sample mean of 180 pounds and sample standard deviation of 30 pounds. Assume the weight distribution is approximately normal.

    (a) Find a 95% confidence interval for the mean weight of all airline passengers during the summer. Show your work.

    (b) Find a 95% prediction interval for the weight of another random selected airline passenger during the summer. Show your work.

(3) Show your work.

    (a) A week before the election, based on a random sample of 1200 voters, the support rate for candidate A is 53%. Can we assert, with 95% confidence, that candidate A is winning the election (in other words, his support rate is higher than 50%)?

    (b) A market research firm is interested in determining the proportion of households that are watching a particular sporting event. To accomplish this task, they plan on using a poll of randomly chosen households. How large a sample is needed if they want to be 90 percent certain that their estimate has a margin of error less than .02?

(4) Show your work.

(a) A light bulb manufacturer sells two models of light bulbs, Model A and Model B. A random sample of 35 Model A bulbs yields a mean life of 1450 hours with a standard deviation of 33 hours. A random sample of 30 Model B bulbs yields a mean life of 1540 hours with a standard deviation of 44 hours.

Find a 95% confidence interval for $\mu_B - \mu_A$.

(b) The following are the average weekly losses of work-hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation:

45 and 36,   73 and 60,   46 and 44,   124 and 119,   33 and 35

57 and 51,   83 and 77,   34 and 29,   26 and 24,   17 and 11

Can we say with 95% confidence that the new safety program made a difference in the mean weekly loss of work-hours due to accidents? Justify your answer.

(5) Let $X_1, X_2, \ldots X_{80}$ be a random sample of size 80 taken from the population with p.d.f.
$$f(x) = 3x^2, \qquad 0 < x < 1.$$

Use the Central Limit Theorem to approximate $P(58 \leq \sum_{i=1}^{80} X_i \leq 64)$. Show your work.

(6) Show your work.

    (a) Throw a fair die 500 times. What is the approximate probability that you will get the sides numbered either "5" or "6" at least 150 times (inclusive)?

    (b) The following are 7 randomly selected observations from an exponential distribution with p.d.f. $f(x) = \dfrac{1}{\theta} e^{-x/\theta}$.

$$17, \quad 14, \quad 27, \quad 8, \quad 12, \quad 19, \quad 12$$

Give a maximum likelihood estimate of the parameter θ. Show your work.