Write all your answers on this sheet. You may use a calculator as well as Tables A and C.

1. Circle the appropriate word in each case where you are given the choice of two in brackets:
   (a) A parameter is a characteristic of a [population sample]
   (b) \( \bar{x} \) is a characteristic of a [sample population]
   (c) \( \mu \) is a [statistic parameter]

2. For a simple random sample of size 400 from a population with mean 8 and standard deviation 3,
   (a) then mean of the distribution of the sample mean is \[ \text{number needed} \]
   (b) the standard deviation of the distribution of the sample mean is \[ \text{number needed} \] and
   (c) the shape of the distribution of the sample mean is (approximately) \[ \text{number} \]

3. Our class has 32 students. 11 are freshmen and 21 are not. If we choose two different students at random, what is the probability that both students will be freshmen?

4. Write a symbol in each blank.
   (a) If the variable that we are interested in is categorical, the parameter that we will usually be interested in is \[ \text{symbol} \].
   (b) If the variable that we are interested in is quantitative, the parameter that we will usually be interested in is \[ \text{symbol} \].

5. We prefer confidence intervals based on the \( t \) distribution to those based on the \( z \) distribution because
   (a) \( z \) requires that our data is an SRS
   (b) \( z \) can be used only for large samples
   (c) \( z \) requires that we know the population standard deviation
6. A manufacturing process is investigated to determine the average lifetime of the parts produced. The distribution of lifetimes of this particular part is skewed right. The four plots below are histograms of the result of 100 different trials of the following four experiments. Match the histogram to the experiment. (Label the histograms (a), (b), (c) or (d).)

(a) A part is chosen at random and its lifetime is recorded.
(b) 5 parts are chosen and the average of their lifetimes is recorded.
(c) 20 different parts are chosen and the average of their lifetimes is recorded.
(d) 50 different parts are chosen and the average of their lifetimes is recorded.

7. In the above question, give a good reason for your answer to part (d) only.
8. A good model for the distribution of scores on the SAT mathematics test for all test takers is that it is normal with mean 500 and standard deviation 110.

(a) What is the probability that a randomly chosen test taker has SAT test score greater than 540?

(b) If 16 randomly chosen students take the test, what is the probability that the average SAT mathematics test score of these 16 is greater than 540?
9. A survey by the Department of Energy resulted in the following claim:

The average amount of electricity in kilowatt hours (kWh) used by a household in the United States in 1997 is 10,219 ± 280.

This estimate resulted from a random sample and is a confidence interval produced by a method that we have used.

(a) In this computation of a confidence interval, 10,219 is _________ (write a symbol)

(b) The report says that the number 280 is computed from 1.96 × 143. In this computation, 1.96 is a [standard deviation sample mean critical value].

(c) The sample size was 1,000. Approximately what is the value of s? _________

(d) What confidence level is the confidence interval? _________

10. A study recorded all the penalties in murder cases in the state of Georgia over the period of several years. In some of the cases, the convicted murderer received the death penalty and in others he/she did not. Researchers wondered whether the penalty was related to the race of the defendant. A contingency table is below.

(a) What is the probability that a randomly chosen defendant is black?

(b) What is the probability that a randomly chosen defendant is sentenced to the death penalty?

(c) What is the probability that a randomly chosen defendant is sentenced to the death penalty given that he/she is black?
11. A window manufacturer wants to know the average strength of the windows it produces. The manufacturer selects 31 window panes at random and subjects them to a breaking strength test. That weight (in kilograms per square inch, ksi) needed to break the panes is recorded. A portion of the data, a Crunchit summary, and a boxplot of all the data is below.

(a) Write a 95% confidence interval for the mean breaking strength of window panes produced by this manufacturer.

(b) What condition on the population do we need to construct confidence intervals by the procedure you (should have) used in (a)?

(c) From the summary and/or boxplot, do you have any reason to believe that the condition you named in (b) is likely to be false? Explain your answer.