Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

1. You measure the age, marital status and earned income of an SRS of 1463 women. The number and type of variables you have measured is
   (a) 1463; all quantitative.
   (b) four; two categorical and two quantitative.
   (c) four; one categorical and three quantitative.
   (d) three; two categorical and one quantitative.
   (e) three; one categorical and two quantitative.

2. Consumers’ Union measured the gas mileage in miles per gallon of 38 1978–1979 model automobiles on a special test track. The pie chart below provides information about the country of manufacture of the model cars used by Consumers Union. Based on the pie chart, we may conclude that:
   (a) Japanese cars get significantly lower gas mileage than cars of other countries. This is because their slice of the pie is at the bottom of the chart.
   (b) U.S. cars get significantly higher gas mileage than cars from other countries.
   (c) Swedish cars get gas mileages that are between those of Japanese and U.S. cars.
   (d) Mercedes, Audi, Porsche, and BMW represent approximately a quarter of the cars tested.
   (e) More than half of the cars in the study were from the United States.

3. A researcher reports that, on average, the participants in his study lost 10.4 pounds after two months on his new diet. A friend of yours comments that she tried the diet for two months and lost no weight, so clearly the report was a fraud. Which of the following statements is correct?
   (a) Your friend must not have followed the diet correctly, since she did not lose weight.
   (b) Since your friend did not lose weight, the report must not be correct.
   (c) The report only gives the average. This does not imply that all participants in the study lost 10.4 pounds or even that all lost weight. Your friend’s experience does not necessarily contradict the study results.
   (d) In order for the study to be correct, we must now add your friend’s results to those of the study and recompute the new average.
   (e) Your friend is an outlier.
4. The following is an ogive on the number of ounces of alcohol (one ounce is about 30 mL) consumed per week in a sample of 150 students.

A study wished to classify the students as “light”, “moderate”, “heavy” and “problem” drinkers by the amount consumed per week. About what percentage of students are moderate drinkers, that is, consume between 4 and 8 ounces per week?
(a) 60%
(b) 20%
(c) 40%
(d) 80%
(e) 50%

5. “Normal” body temperature varies by time of day. A series of readings was taken of the body temperature of a subject. The mean reading was found to be 36.5°C with a standard deviation of 0.3°C. When converted to °F, the mean and standard deviation are °F = °C(1.8) + 32.
(a) 97.7, 32
(b) 97.7, 0.50
(c) 97.7, 0.54
(d) 97.7, 0.97
(e) 97.7, 1.80

6. The following is a histogram showing the actual frequency of the closing prices on the New York exchange of a particular stock. Based on the frequency histogram for New York Stock exchange, the class that contains the 80th percentile is:
(a) 20-30
(b) 10-20
(c) 40-50
(d) 50-60
(e) 30-40
7. What do we call a sample that consists of the entire population?
   (a) A stratum
   (b) A multistage sample
   (c) A mistake. A sample can never be the entire population.
   (d) A census
   (e) None of the above. The answer is ________________________

8. A member of Congress wants to know what his constituents think of proposed legislation on health insurance. His staff reports that 228 letters have been received on the subject, of which 193 oppose the legislation. What is the population in this situation?
   (a) The constituents
   (b) The 228 letters received
   (c) The 193 opposing the legislation
   (d) Congress
   (e) None of the above. The answer is ________________________

9. Which of the following is a method for improving the accuracy of a sample?
   (a) Use no more than 3 or 4 words in any question.
   (b) When possible, avoid the use of human interviewers, relying on computerized dialing instead.
   (c) Use large sample sizes.
   (d) Use smaller sample sizes.
   (e) None of the above. The answer is ________________________

10. We say that the design of a study is biased if which of the following is true?
    (a) A racial or sexual preference is suspected.
    (b) Random placebos have been used.
    (c) Certain outcomes are systematically favored.
    (d) The correlation is greater than 1 or less than -1.
    (e) None of the above. The answer is ________________________

11. Control groups are used in experiments in order to . . .
    (a) Control the effects of lurking variables such as the placebo effect
    (b) Control the subjects of a study so as to insure all participate equally
    (c) Guarantee that someone other than the investigators, who have a vested interest in the outcome, control how the experiment is conducted
    (d) Achieve a proper and uniform level of randomization
    (e) None of the above. The answer is ________________________
12. Which of the following is likely to have a mean that is smaller than the median?
   (a) The salaries of all National Football League players.
   (b) The scores of students (out of 100 points) on a very easy exam in which most get nearly perfect scores but a few do very poorly.
   (c) The prices of homes in a large city.
   (d) The scores of students (out of 100 points) on a very difficult exam in which most get poor scores but a few do very well.
   (e) Amounts awarded by civil court juries.

12. There are three children in a room, ages three, four, and five. If a four-year-old child enters the room the
   (a) mean age will stay the same but the variance will increase.
   (b) mean age will stay the same but the variance will decrease.
   (c) mean age and variance will stay the same.
   (d) mean age and variance will increase.
   (e) mean age and variance will decrease.

14. The weights of the male and female students in a class are summarized in the following boxplots:

   Which of the following is NOT correct?
   (a) About 50% of the male students have weights between 150 and 185 pounds.
   (b) About 25% of female students have weights more than 130 pounds.
   (c) The median weight of male students is about 162 pounds.
   (d) The mean weight of female students is about 120 pounds because of symmetry.
   (e) The male students have less variability than the female students.

15. When testing water for chemical impurities, results are often reported as bdl, that is, below detection limit. The following are the measurements of the amount of lead in a series of water samples taken from inner-city households (ppm).

   5, 7, 12, bdl, 10, 8, bdl, 20, 6

   Which of the following is correct?
   (a) The mean lead level in the water is about 10 ppm.
   (b) The mean lead level in the water is about 8 ppm.
   (c) The median lead level in the water is 7 ppm.
   (d) The median lead level in the water is 8 ppm.
   (e) Neither the mean nor the median can be computed because some values are unknown.
Part 2: Free Response

Communicate your thinking clearly and completely.

The test grades for a certain class were entered into a Minitab worksheet, and then “Descriptive Statistics” were requested. The results were:

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MTB > Describe 'Grades'.

Grades       N   MEAN   MEDIAN   TRMEAN   STDEV   SEMEAN
             28  74.71   76.00   75.50    12.61    2.38

Grades       MIN   MAX   Q1     Q3
             35.00  94.00  68.00  84.00
```

You happened to see, on a scrap of paper, that the lowest grades were 35, 57, 59, 60, . . . . but you don’t know what the other individual grades are. Nevertheless, a knowledgeable user of statistics can tell a lot about the dataset simply by studying the set of descriptive statistics above.

(a) Write a brief description of what the results tell you about the distribution of grades. Be sure to address:
- the general shape of the distribution
- unusual features, including possible outliers
- the middle 50% of the data
- any significance in the difference between the mean and the median

(b) Construct a modified boxplot for these data.
17. Is this study an experiment? Explain why or why not.

18. Identify the sample and the population in the opinion poll in (6).

Read the brief article about aspirin and alcohol.

**Aspirin may enhance impairment by alcohol**

Aspirin, a long time antidote for the side effects of drinking, may actually enhance alcohol's effect, researchers at the Bronx Veteran's Affairs Medical Center say.

In a report on a study published in the Journal of the American Medical Association, the researchers said they found that aspirin significantly lowered the body's ability to break down alcohol in the stomach.

As a result, five volunteers who had a standard breakfast and two extra-strength aspirin tablets an hour before drinking had blood alcohol levels 30 percent higher than when they drank alcohol alone. Each volunteer consumed the equivalent of a glass and a half of wine.

That 30 percent could make the difference between sobriety and impairment, said Dr. Charles S. Lieber, medical director of the Alcohol Research and Treatment Center at the Bronx center, who was co-author of the report with Dr. Risto Roine.

19. Does this article describe an experiment? Explain.

20. Did this study involve a simple random sample (SRS)? Explain.

21. Did this study use a particular design that we have studied? If so, identify the design. Then comment on the validity of the study.
You are participating in the design of a medical experiment to investigate whether or not a calcium supplement in the diet will reduce the blood pressure of middle-aged men. Preliminary research suggests that the supplement may have a greater effect on black men than on white men.

22. What sort of experimental design would you choose, and why?

23. Assume that the experimental population consists of 600 white men and 500 black men. Outline in a diagram the design of the experiment. (Be sure to indicate how many subjects are assigned to the various treatment groups.)

24. Use Line 134 of the Random Number Table to select the first 5 whites for the study, and use Line 142 to select the first 5 blacks for the study.
Bias is present in each of the following sampling designs. In each case, identify the type of bias involved and state whether you think the sampling frequency obtained is lower or higher than the actual population parameter.

25. A political pollster seeks information about the proportion of American adults that oppose gun controls. He asks a SRS of 1000 American adults: “Do you agree or disagree with the following statement: Americans should preserve their constitutional right to keep and bear arms.” A total of 910, or 91%, said, "agree" (that is, 910 out of the 1000 oppose gun controls).

26. A flour company in Minneapolis wants to know what percentage of local households bake at least twice a week. A company representative calls 500 households during the daytime and finds that 50% of them bake at least twice a week.

It is believed that 75% of all apartment dwellers in a large city deadbolt their doors in addition to locking them as an added precaution against burglary.

27. Describe (in words, and in detail) how you would simulate a SRS of 20 apartment dwellers.

28. Beginning at line 127 in the random digit table, actually simulate a SRS of 20 apartment dwellers. (Reminder: Show Your Work!) What is the proportion $p$ of people in the sample who deadbolt their doors?
The following table gives the Nielsen ratings for the top 50 prime-time television shows for the first half of the 1994-95 viewing season. Each ratings point represents 954,000 households.

<table>
<thead>
<tr>
<th>Show</th>
<th>Network</th>
<th>Rating</th>
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</thead>
<tbody>
<tr>
<td>Home Improvement</td>
<td>ABC</td>
<td>20.8</td>
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<tr>
<td>Grace Under Fire</td>
<td>ABC</td>
<td>20.0</td>
</tr>
<tr>
<td>Seinfeld</td>
<td>NBC</td>
<td>19.7</td>
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<td>E.R.</td>
<td>NBC</td>
<td>18.5</td>
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<td>NYPD Blue</td>
<td>ABC</td>
<td>18.1</td>
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<td>60 Minutes</td>
<td>CBS</td>
<td>17.9</td>
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<td>Monday Night Football</td>
<td>ABC</td>
<td>17.4</td>
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<td>Roseanne</td>
<td>ABC</td>
<td>17.3</td>
</tr>
<tr>
<td>Murder, She Wrote</td>
<td>CBS</td>
<td>16.2</td>
</tr>
<tr>
<td>Ellen</td>
<td>ABC</td>
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<td>Frasier</td>
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<td>NBC</td>
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<td>Murphy Brown</td>
<td>CBS</td>
<td>14.8</td>
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<td>CBS</td>
<td>14.7</td>
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<tr>
<td>Madman of the People</td>
<td>NBC</td>
<td>14.6</td>
</tr>
<tr>
<td>NBC Monday Movie</td>
<td>NBC</td>
<td>14.1</td>
</tr>
<tr>
<td>Friends</td>
<td>NBC</td>
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</tr>
<tr>
<td>Dave's World</td>
<td>CBS</td>
<td>13.8</td>
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<tr>
<td>20/20</td>
<td>ABC</td>
<td>13.7</td>
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<tr>
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<td>Full House</td>
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<td>Law and Order</td>
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<td>Love and War</td>
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<td>Wings</td>
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<td>Beverly Hills, 90210</td>
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<td>Walker, Texas Ranger</td>
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<td>CBS Tuesday Movie</td>
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<td>Boy Meets World</td>
<td>ABC</td>
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<td>John Larroquette Show</td>
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<td>Hangin' with Mr. Cooper</td>
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<td>Turning Point</td>
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<td>11.2</td>
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<tr>
<td>Earth 2</td>
<td>NBC</td>
<td>10.9</td>
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<tr>
<td>Due South</td>
<td>CBS</td>
<td>10.9</td>
</tr>
<tr>
<td>Rescue 911</td>
<td>CBS</td>
<td>10.9</td>
</tr>
<tr>
<td>Chicago Hope</td>
<td>CBS</td>
<td>10.7</td>
</tr>
<tr>
<td>Fresh Prince of Bel-Air</td>
<td>NBC</td>
<td>10.6</td>
</tr>
<tr>
<td>Blossom</td>
<td>NBC</td>
<td>10.6</td>
</tr>
<tr>
<td>All-American Girl</td>
<td>ABC</td>
<td>10.5</td>
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<tr>
<td>Diagnosis Murder</td>
<td>CBS</td>
<td>10.5</td>
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<td>The Cosby Mysteries</td>
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<td>10.5</td>
</tr>
<tr>
<td>Picket Fences</td>
<td>CBS</td>
<td>10.3</td>
</tr>
<tr>
<td>SeaQuest DSV</td>
<td>NBC</td>
<td>10.2</td>
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</tbody>
</table>

(a) Make a stemplot of the ratings for the 16 programs that were broadcast by ABC.

(b) How does ABC compare with NBC in the race for high ratings? Give appropriate graphical and numerical evidence to support your answer.