Part I - Multiple Choice (Questions 1-10) - Circle the answer of your choice.

1. Which one of the following is not a principle of experimentation?
   
   (a) Randomly allocating experimental units to treatments.
   
   (b) Stratifying the experimental units into groups of similar individuals and applying different treatments to each stratum.
   
   (c) Using doubleblindness to eliminate bias.
   
   (d) Replicating to measure overall experimental error and increase precision.
   
   (e) Using a control group to determine whether treatment really works.

2. A simple random sample of size \( n \) is selected in such a way that
   
   (a) Each member of the population has an equal chance of being selected.
   
   (b) Each member of the population is given an opportunity to respond to the survey.
   
   (c) All samples of size \( n \) have the same chance of being selected.
   
   (d) The probability of selecting any sample is known to be \( 7 \rightarrow \text{rand} \).
   
   (e) The sample is guaranteed to represent the entire population.

3. In sample surveys, bias can be controlled by all of the following except
   
   (a) Using a probability or chance sampling procedure.
   
   (b) Wording questions so they are not confusing or misleading.
   
   (c) Carefully training and supervising interviewers.
   
   (d) Prompting respondents so that they give correct responses.
   
   (e) Reducing non-response and undercoverage.

4. A graduate student conducts a study to determine whether a new activity-based method is better than the traditional lecture of teaching statistics. He found two teachers to help him in his study for one semester. Mr. Dull volunteered to continue teaching with traditional lectures and Ms. Perky agreed to try the new activity-based method. Each teacher planned to teach two sections of approximately forty students each for adequate replication. At the end of the semester, all sections would take the same final exam and their scores would be compared. What is the treatment variable in this study?
   
   (a) Teacher
   
   (b) Section of the Course
   
   (c) Teaching Method
   
   (d) Final Exam Score
   
   (e) Student

5. In a study on the effect of reinforcement on learning from programmed text, two experimental treatments are planned: reinforcement given after every frame of programmed text or reinforcement given after every three frames. Which one of the following control groups would serve best in this study?
   
   (a) A group which does not read the programmed text material.
   
   (b) A group that reads the programmed material in prose formats.
   
   (c) A group which reads the programmed material but does not receive reinforcement.
   
   (d) A group that reads the programmed text material and reinforcement is given at random.
   
   (e) A group which watches the video of the programmed material.
6. 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) The research designer has received a grant from a special interest group.
(d) The correlation is greater than 1 or less than –1.
(e) Certain outcomes are systematically favored.

7. Which of the following are true statements?

I. Voluntary response samples often overrepresent people with strong opinions.
II. Convenience samples often lead to undercoverage bias.
III. Questionnaires with nonneutral wording are likely to have response bias.

(a) I and II
(b) I and III
(c) II and III
(d) I, II, and III
(e) None of the above gives the true set of responses.

8. To survey the opinions of bleacher fans at Wrigley Field, a surveyor plans to select every one-hundredth fan entering the bleachers one afternoon. Will this result in a random sample?

(a) Yes, because each bleacher fan has the same chance of being selected.
(b) Yes, but only if there is a single entrance to the bleachers.
(c) Yes, because the 99 out of 100 bleacher fans that are not selected will form a control group.
(d) Yes, because this is an example of systematic sampling, which is a special case of random sampling.
(e) No, because each fan does not have the same chance of being selected.

9. What fault do all these sampling designs have in common?

I. The Wall Street Journal plans to make a prediction for a presidential election based on a survey of its readers.
II. A radio talk show asks people to phone in their views on whether the United States should pay off its huge debt to the United Nations.
III. A police detective is interested in determining a sample of high school students and interviews each one about any illegal drug use by the student during the past year.

(a) All the designs make improper use of stratification.
(b) All the designs have errors that can lead to strong bias.
(c) All the designs confuse association with cause and effect.
(d) None of the designs satisfactorily controls for sampling error.
(e) None of the designs makes use of chance in selecting a sample.

10. The following students are available to serve on the Student Procrastination Committee.

|---------|---------|--------|-----------|------|---------|

Using the randInt function on your TI-83, select a simple random sample size 4. Before you select your sample, seed your random number generator by storing 7 into rand [7 → rand]. The students who were selected were:

(a) Ally, Ramone, Kyle, Olive
(b) Donald, Ramone, Kyle, Frannie
(c) Jan, Kyle, Kyle, Ramone
(d) Gina, Ivana, Patti, Eli
(e) Norm, Donald, Morris, Frannie
Part II – Free Response (Questions 11-14) – Show your work and explain your results clearly.

11. P.P. Pumpkineater, the renowned agricultural geneticist, has mutated previous varieties of pumpkins and produced two new strains, Scary Face and Candle Breath. Because he has limited marketing funds, he must decide which strain is the most “jack-o-lanternable”. Having been in the jack-o-lantern business for a long period of time, he has developed the PPPJOL Test to compare different strains. He is quite concerned about the effects of sunlight and water on the growth of the pumpkins. He has 60 seeds of each variety available for testing.

Design an experiment that will help P.P. determine which strain to market.

12. At the recently opened theme park, Six Samples Over a Population, a carnival game allows a player three attempts, using a dart, to pop a balloon. As soon as the player pops the balloon, he wins the prize and the game is over. If he does not pop the balloon after the third attempt he loses. Niloy, an avid dart-throwing balloon popper, estimates his probability of popping the balloon on the first attempt at 20%, popping the balloon on the second attempt at 30%, and popping the balloon on the third attempt at 40%. By describing an appropriate random digit assignment and performing 10 simulations using the given random number table, determine the probability that Niloy wins the prize.

0 8 4 2 4 4 4 7 5 3 7 7 3 7 7 2 8 7 4 4 7 5 5 9 2 0 8 5 6 3 7 9 1 4 0 9 2 4 5 4
5 3 6 4 5 6 6 8 1 2 6 1 4 2 1 4 7 8 3 6 1 2 6 0 9 1 5 3 7 3 9 8 4 8 1 1 4 5 9 2

13. Is the right foot more powerful than the left? A researcher decides to measure foot power by having subjects kick a large Styrofoam block and measure the depth of the impression. Twenty subjects are available for the experiment.

(a) Design a completely randomized experiment to test the hypothesis.

(b) Design a matched pairs experiment to test the hypothesis.

(c) Comment on which experiment may be more appropriate and concerns you may have about the experimental design.

14. You have been asked to investigate the attitudes of students in the Upper School about the school’s uniform policy. You only have enough time and resources to contact 120 students. Describe your sample design clearly. Comment on any practical difficulties that you anticipate.