**AP Statistics Name:  
Special Problem 9 (S-2017)**

**Directions**: Complete the following problems as you would on the AP Exam. Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations. This is an individual effort. You can use your book or notes but no other outside resources including the internet.  
  
**Problem 1**. A software company is trying to decide whether to produce an upgrade to one of its programs. Customers would have to pay $100 for the upgrade. For the upgrade to be profitable, the company needs to sell it to more than 15% of their customers. You contact a random sample of 60 customers and find that 14 would be willing to pay $100 for the upgrade.

(a) Do the sample data give good evidence that more than 15% of the company’s customers are willing to purchase the upgrade? Carry out an appropriate test at the α = 0.05 significance level.

(b) Which would be a more serious mistake in this setting -- a Type I error or a Type II error? Justify your answer.

(c) Other than increasing sample size, describe one way to increase the power of the test in (a).

**Problem 2**. “I can’t get through my day without coffee” is one common statement from many students. Assumed benefits include keeping students awake during lectures and making them more alert for exams and tests. Students in a statistics class designed an experiment to measure memory retention with and without drinking a cup of coffee one hour before a test. This experiment took place on two different days in the same week (Monday and Wednesday). Ten students were used. Each student received no coffee or one cup of coffee, one hour before the test on a particular day. The test consisted of a series of words flashed on a screen, after which the student had to write down as many words as possible. On the other day, each student received a different amount of coffee (none or one cup).

(a) One of the researchers suggested that all the subjects in the experiment drink no coffee before Monday’s test and one cup of coffee before Wednesday’s test. Explain to the researcher why this is a bad idea.

(b) Describe how the researchers should carry out a completely randomized design for this experiment. Include a description of how the treatments should be assigned.

(c) The data from the experiment are provided in the table below. Set up and carry out an appropriate test to determine whether there is convincing evidence that drinking coffee improves memory.

|  |  |  |
| --- | --- | --- |
| Student | No Cup | One Cup |
| 1 | 22 | 25 |
| 2 | 30 | 31 |
| 3 | 22 | 23 |
| 4 | 23 | 24 |
| 5 | 26 | 27 |
| 6 | 23 | 25 |
| 7 | 26 | 28 |
| 8 | 20 | 20 |
| 9 | 25 | 27 |
| 10 | 26 | 30 |