Name _____ Spring 2015

Applied Statistics Comprehensive Examination

Statistical Methods I & II

- Calculators are permitted on this part of the examination.
- When you are asked to construct confidence intervals, always interpret the intervals in terms of the problem.
- When you are asked to perform hypothesis tests, always write down the null and alternative hypotheses and write the conclusions in terms of the problem.

1. (25 pts) The General Mills data analysis team claims that people living in the U.S. eat cereal for breakfast an average of 71 times per year. The CEO of Kellogg's believes the true number is higher and decides to conduct his own study. Based on a random sample of 28 people living in the U.S., the study finds that they eat cereal for breakfast an average of 82 times per year with a standard deviation of 32 times per year.

(a) (15 pts) Conduct the test of interest at the 0.05 level of significance.
(b) (10 pts) Assuming that 32 is the true standard deviation, what sample size would be necessary in order to have 90% power for detecting the alternative hypothesis in part a if the true mean is 75 times per year. Continue to use the 0.05 level of significance.

2. (25 pts) A random sample of 100 U.S. citizens in 1950 determined that 34% liked baseball the best among all U.S. sports. A more recent 2014 poll, also based on a random sample of 100 U.S. citizens, found that only 20% liked baseball the best among all U.S. sports.

(a) (15 pts) Estimate with 95% confidence the difference in the proportions of U.S. citizens liking baseball best in 1950 and 2014.
   (i) Conduct the appropriate sample size check.
   (ii) Find the confidence interval.
   (iii) Interpret the interval in terms of the problem.

(b) (10 pts) Suppose that we instead conducted a test at the 0.05 significance level to determine if baseball was more popular in 1950 than in 2014. Without actually conducting this test, determine how the following would affect the power relative to this proposed test (Please write at most one sentence for each of the following parts):
   (i) Sample sizes are unchanged but the level of significance is decreased to 0.01.
   (ii) Sample sizes are both increased but the level of significance is left unchanged at 0.05.
   (iii) One sample size stays the same, one sample size is increased, and the level of significance is increased to 0.1.

3. (15 pts) A new lumber company in Philadelphia is considering hiring one of two trucking companies for deliveries to San Diego. A random sample of 25 previous Philadelphia to San Diego deliveries indicated Trucking Company A averaged 4.5 days for the cross-country trip with a standard deviation of 1.1 days while an independent random sample of size 25 for Trucking Company B indicated they averaged 4.5 days with a standard deviation of 0.6 days. Management at the new lumber company would like to choose Trucking Company A because it is less expensive. However, it will choose Company B if it is determined that the variance associated with Company A is larger.

Can we conclude at the 0.1 level that the variance in delivery times from Philadelphia to San Diego is higher for Trucking Company A? Assume that delivery times are normally distributed.

4. (35 pts) An agricultural experiment station tested two different herbicides to assess their effects on crop yield. From 40 one-acre plots set aside for the experiment, herbicides 1 and 2 were each randomly assigned to 15 plots and the remaining 10 plots were used as a control. At the end of the growing season, the summary statistics for yields (in bushels per acre) were as follows:

	Sample Mean	Sample Standard Deviation
Herbicide 1	90.2	6.5
Herbicide 2	87.6	7.8
Control	80.5	7.4

(a) (10 pts) Identify the experimental design and state the appropriate mathematical model.

(b) (15 pts) Complete the ANOVA table and test the hypothesis of no treatment differences using the 0.05 level of significance. Note that the total sum of squares is 2516.

(c) (10 pts) Indicate what plots should be included in a residual analysis of these data and briefly discuss their purpose.