Name _____ Spring, 2013

Applied Statistics Comprehensive Examination

Statistical Methods I & II

1. (20 pts) A committee was formed to study traffic conditions in an industrial complex. The committee wanted to see whether the modes of transportation used to get to work had changed over the past 5 years. Five years ago, 70% of the workers had driven alone; 20% had been in a car pool; 8% had used public transportation and the rest had used other modes. A sample of 500 workers found that now 320 drove alone; 130 used a carpool; 35 used public transportation and 15 used other means. Using a 5% level of significance, determine if the distribution of the modes of transportation used to get to work has changed over the past 5 years.

2. (30 pts) A production manager claimed that there was no difference among the company's four manufacturing plants in the time to complete a particular job. Samples from each of the plants yielded the following data:

Plant 1	18	11	14	12	15
Plant 2	20	14	16	18	
Plant 3	23	16	21		
Plant 4	12	18	17	13	

   (a) (5 pts) Plot the data in an appropriate manner and make a preliminary judgment about the equality of means and variances among the Plants.

   (b) (5 pts) State the appropriate mathematical model and all of its assumptions for this experimental situation.

   (c) (10 pts) Use these data to construct the ANOVA table and determine if there are treatment differences, using $\alpha = 0.05$. The total sum of squares is 177.75 and the treatment (or among Plant) sum of squares is 77.75.

   (d) (10 pts) Construct a 95% confidence interval for the difference in means between Plants 1 and 2.

3. (30 pts) An office manager has implemented an incentive plan that she thinks will reduce the mean time required to handle a customer complaint, which was 30 minutes prior to implementing the plan. After the plan was in place for several months, a random sample of the records of 36 customers who had complaints revealed a mean time of 28.7 minutes with a standard deviation of 3.6 minutes.

   (a) (15 pts) Using a significance level of 0.05, determine if there is sufficient evidence that the incentive plan has reduced the mean time to handle a complaint. Estimate the P–value of the test statistic.

   (b) (15 pts) Estimate the power of the above test if the true mean after implementing the incentive plan was reduced to 27 minutes.

4. (20 pts) Suppose that some data were collected on the relationship between temperature (x) in degrees Fahrenheit at 11 A.M. and the number of customers (y) using the health spa facilities at that time for six randomly selected days during the summer. A regression analysis in MINITAB yielded the following output.

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Regression Analysis

The regression equation is
customers = 66.3 - 0.604 temperature

Predictor       Coef       StDev          T        P
Constant       66.29       11.54       5.75    0.005
temperat     -0.6037      0.1496      -4.04    0.016

Analysis of Variance

Source         DF          SS          MS         F        P
Regression      1      155.77      155.77     16.30    0.016
Error           4       38.23        9.56
Total           5      194.00
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   (a) (5 pts) State the appropriate mathematical model and all of its assumptions for this regression analysis.

   (b) (10 pts) Use the P-value approach to determine if there is a significant ($\alpha = 0.05$) linear relationship between the two variables. Be sure to clearly identify the null and alternative hypotheses, the value of test statistic and the reason for your statistical decision.

   (c) (5 pts) Determine the linear correlation coefficient between these two variables and interpret its value.