LINEAR REGRESSION MODELS W4315

HOMEWORK 3 QUESTIONS

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1. (50 points) [1] Refer to **Copier maintenance** Problem 1.20.

a. Estimate the change in the mean service time when the number of copiers serviced increases by one. Use a 90 percent confidence interval. Interpret your confidence interval.

b. Conduct a t test to determine whether or not there is a linear association between X and Y here; control the α risk at .10. State the alternatives, decision rule, and conclusion. What is the P-value of your test?

c. Are your results in parts (a) and (b) consistent? Explain.

d. The manufacturer has suggested that the mean required time should not increase by more than 14 minutes for each additional copier that is serviced on a service call. Conduct a test to decide whether this standard is being satisfied by Tri-City. Control the risk of a Type I error at .05. State the alternatives, decision rule, and conclusion. What is the P-value of the test?

e. Does b_0 give any relevant information here about the "start-up" time on calls-i.e., about the time required before service work is begun on the copiers at a customer location?

2. (20 points) [2] Consider the test problem in a normal error regression model:

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i$$

where:

β_0 and β_1 are parameters
X_i are known constants
ϵ_i are independent $N(0, \sigma^2)$

[1] This is problem 2.5 in "Applied Linear Regression Models(4th edition)" by Kutner etc.

[2] This is problem 2.19 in "Applied Linear Regression Models(4th edition)" by Kutner etc.

When testing whether or not $\beta_1 = 0$, why is the F test a one-sided test even though H_a includes both $\beta_1 < 0$ and $\beta_1 > 0$? [Hint: refer to the following problem]

3. (30 points) [3] Consider the same normal regression model as in problem 2.
a. When testing $H_0 : \ \beta_1 = 5$ versus $H_a : \ \beta_1 \neq 5$ by means of a general linear test, what is the reduced model? What are the degrees of freedom df_R?
b. When testing $H_0 : \ \beta_0 = 2, \ \beta_1 = 5$ versus H_a : not both $\beta_0 = 2$ and $\beta_1 = 5$ by means of a general linear test, what is the reduced model? What are the degrees of freedom df_R?

[3] This is problem 2.57 in "Applied Linear Regression Models(4th edition)" by Kutner etc.