KFUPM | Term 043 | Date: 7/8/2005

Mathematical Sciences | STAT 212 | Duration: 15 minutes

Quiz# 5

Name: ID#: Section#: 1 2 Serial#:

Fill the FINAL answers in the blanks and Show your FULL work beneath the questions

An accountant wishes to predict direct labor cost (y) on the basis of the batch size (x) of a product produced in a job shop. Data results from 12 production runs are given below,

$n = 6$, $\sum x = 548$, $\sum x^2 = 34978$, $\sum y = 5782$, $\sum y^2 = 3811300$, $\sum xy = 365027$, and $SSE = 747$

Based on the previous sample information, answer the following:

a. The least squares regression model is $\hat{y} =$ 18.488 + 10.146x.

b. The percent of the variation in labor cost that is explained by the batch size = 0.999

c. Testing the statistical significance of the regression model gives (Acc/(Rej.))

d. Predicting the labor cost for a college graduate with a batch size of 50 = 525.80

a. $b_1 = \dfrac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} = \dfrac{365027 - \frac{(548)(5782)}{12}}{34978 - \frac{(548)^2}{12}} = 10.146$

$b_0 = \bar{y} - b_1 \bar{x} = \dfrac{5782}{12} - (10.14)\dfrac{548}{12} = 18.488$

b. $R^2 = \dfrac{SSR}{SST} = \dfrac{SST - SSE}{SST} = \dfrac{\left(\sum y^2 - \frac{(\sum y)^2}{n}\right) - 747}{\sum y^2 - \frac{(\sum y)^2}{n}} = \dfrac{1025340 - 747}{3811300 - \frac{(5782)^2}{12}}$

$= \dfrac{1024593}{1025340} = 0.999$

c. $H_0: \beta_1 = 0$ $\Rightarrow F_0 = \dfrac{MSR}{MSE} = \dfrac{SSR/1}{SSE/(n-2)} = \dfrac{1024593}{74.7} = 13720.47$

$H_A: \beta_1 \neq 0$

$F_{\alpha, k, n-k-1} = F_{0.05, 1, 10} = 4.965$

Since $F_0 = 13720.47 > 4.965 = F_\alpha \Rightarrow$ Reject H_0

The model is significant.

d. $\hat{y} = b_0 + b_1(50) = 18.481 + 10.146(50) = 525.80$

With My Best Wishes

KFUPM
Mathematical Sciences

Term 043
STAT 212
Quiz# 5

Date: 7/8/2005
Duration: 10 minutes

Name: ID#: Section#: 1 2 Serial#:

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The following Minitab output gives the analysis of a set of data that were collected by n accountant who wishes to predict direct labor cost (y) on the basis of the batch size (x) of a product produced in a job shop.

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The regression equation is
LaborCost = 18.5 + 10.1 BatchSize

Predictor      Coef  SE Coef       T      P
Constant     18.488    4.677    3.95  0.003
BatchSize   10.1463   0.0866  117.13  0.000

S = 8.64154   R-Sq = 99.9%   R-Sq(adj) = 99.9%

Analysis of Variance

Source           DF       SS       MS         F      P
Regression        1  1024593  1024593  13720.47  0.000
Residual Error   10      747       75
Total            11  1025340

Predicted Values for New Observations

New
Obs      Fit  SE Fit        95% CI            95% PI
  1   525.80    2.52  (520.18; 531.42)  (505.74; 545.86)

Values of Predictors for New Observations

New
Obs  BatchSize
  1       50.0
```

From the previous output, find the following:

a. The sample size is 12 and the correlation coefficient is 0.999.

b. The intercept of the estimated regression equation is 18.5.

c. The slope of the estimated regression equation is 10.1.

d. The standards deviation of the variation about the regression line is 8.64154.

e. Testing that there is a linear relationship between the two variables (Acc/Rej). $H_0: \beta_1 = 0$, $H_A: \beta_1 \neq 0$

f. MSE = 75, SST = 1025340 and SSR = 1024593.

g. A95% CI for a labor cost given that the batch size is 50 is [505.74, 545.86].

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