King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia
Department of Mathematics

STAT 513: Statistical Modelling

Term 212, First Major Exam, Sunday March 6, 2022, 05:20 PM

Name: _____ ID #: _____

Q. No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Marks Obtained									
Full Marks	3	2	2	5	2	3	5	3	25

Download the data file from Blackboard and write the code number as follows: Code _____

Data are given for 21 houses on their selling price, number of bath rooms, living space, number of garage stalls, number of rooms and age of the house.

Q1: (3 pts.) Fit a linear regression model to predict selling price (y) based on number of bath rooms (x_1), living space (x_2), number of garage stalls (x_3), number of rooms (x_4) and age of the house (x_5). Estimate the following regression model:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \epsilon$$

The fitted regression equation is:

$$\hat{y} = \_\_\_\_\_ + \_\_\_\_\_ x_1 + \_\_\_\_\_ x_2 + \_\_\_\_\_ x_3 + \_\_\_\_\_ x_4 + \_\_\_\_\_ x_5$$

Q2: (2 pts.) Calculate SST of the model and write down the detailed interpretation of your answer.

SST = _____

Interpretation:

Q3: (2 pts.) Calculate $\hat{\sigma}^2$ i.e. the estimated variance of ϵ. Also write the interpretation of your answer

$\hat{\sigma}^2 =$ _____

Interpretation:

Q4: (5 pts.) Test the hypothesis $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against the alternative that at least one of the coefficients is not zero. Answer the following questions:

Calculated F statistic = _____

P-value = _____

Reject H_0 if _____

Decision: Circle the correct choice →

(a) Reject H_0

(b) Do not reject H_0

Conclusion:

Q5: (2 pts.) Estimate the variance of coefficient $\hat{\beta}_2$.

$\widehat{\mathrm{Var}}(\hat{\beta}_2) =$ _____

Q6: (3 pts.) Predict the selling price of a house for which the number of bath rooms is 2, living space 1.115, number of garage stalls 1, number of rooms 6 and age of the house 29. Also construct a 99% prediction interval and interpret the interval.

Predicted selling price = _____

99% prediction interval = (_____ , _____)

Interpretation:

Q7: (5 pts.) Using the hat matrix, test whether the prediction done in Q6 is interpolation or extrapolation.

h_{max} = _____

h_{00} = _____

Circle the correct choice →

(a) Interpolation

(b) Extrapolation

Q8: (3 pts.) Construct a 99% confidence interval for average change in selling price due to a unit change in living space, holding the other predictors.

Good Luck