



UNIVERSITY OF MORATUWA

FACULTY OF ENGINEERING

DEPARTMENT OF MATHEMATICS

B. Sc. ENGINEERING HONOURS DEGREE SEMESTER 8 – 2016 INTAKE

MA4013- LINEAR MODELS AND MULTIVARIATE STATISTICS

FINAL ASSIGNMENT I

Answer All questions.

Time: 1.5 hours

Question 1

A university bookstore must order books two months before each semester starts. They believe that the number of books that will ultimately be sold for any particular course is related to the number of students registered for the course when the books are ordered. They would like to develop a linear regression equation to help plan how many books to order. From past records, the bookstore obtains the number of students registered, X , and the number of books actually sold for a course, Y , for 12 different semesters. These data are below:

Students (X)	36	28	35	39	30	30	31	38	36	38	29	26
Books (Y)	31	29	34	35	29	30	30	38	34	33	29	26

- (a). Assuming a model, $Y = \beta_0 + \beta_1 X + \varepsilon$, what are the least square estimates of β_0 and β_1 ? What is the fitted model?

- (b). Construct the analysis of variance table and state and test of hypothesis with an α risk of 0.05.
- (c). Find confidence interval for β_1 with an α risk of 0.05.
- (d). Predict the number of books actually sold for a course when the number of students registered is 33.
- (e). Test at the 5% significance level if β_1 is positive.

Question 2

Suppose the sales manager of a company wishes to investigate how sales performance, Y , depends on five independent variables:

X_1 = number of months the sales representative has been employed by the company

X_2 = sales of the company's product and competing products in the sales territory

X_3 = dollar advertising expenditure in the territory

X_4 = weighted average of the company's market share in the territory for the previous four years

X_5 = change in the company's market share in the territory over the previous four years

A random sample of 26 observations shows the following results:

	Coefficients	Standard Error
Intercept	-1113.00	420.00
X_1	3.60	1.20
X_2	0.04	0.01
X_3	0.13	0.04
X_4	256.95	175.20
X_5	324.50	200.00

Analysis of Variance

Source of Variation	Degree of Freedom	Sum of Square (in 1000)	Mean Sum of Squares	F value
Regression	39500
Residual	
Total	43000		

- (a). Complete the ANOVA table.
 - (b). Test the overall significance of the model using 5% significance level
 - (c). Compute the value of the coefficient of determination (R^2) and give a simple interpretation for the value of R^2 that you calculated.
 - (d). Utilizing the information from above, compute the t-statistics for the regression parameters and Test the significance of the parameters using 5% significance level.
 - (e). Write down the final model.
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