MA329 Statistical linear models 22-23

Assignment 1 (Due date: Sept 30, 11pm. For late submission, each day costs 10 percent)

1. (50 marks, don't use R outcome directly) Suppose an appliance store conducts a 5-month experiment to determine the effect of advertising on sales revenue. The results are shown below.

Advertising Expenditure x (hundreds of dollars)	1	2	3	4	5
Sales Revenue y (thousands of dollars)	1	1	2	2	4

   (a) Draw a scatterplot of the data and comment the relationship between y and x.

   (b) What is your linear regression model? State the necessary assumptions.

   (c) Find the least squares line from the data and plot it on your scatterplot.

   (d) Test the hypothesis that the Advertising Expenditure has no effect of the Sales Revenue when a linear model is used (use $\alpha = 0.05$). State the null and alternative hypotheses. Draw the appropriate test conclusions.

   (e) Find a 95% confidence interval for β_1 (slope of the linear regression model). Interpret your results.

   (f) Find the coefficient of determination for the linear regression model. Interpret your result.

   (g) Find a prediction for the mean Sales Revenue when 4 hundreds dollars are spent on advertising and its 95% interval. What is the 95% interval for the Sales Revenue?

2. (20 marks)

   (a) Define a simple linear regression model and derive MLE (maximum likelihood estimation) for all the unknown parameters

   (b) Comments on the difference between MLE and LSE (least square estimation)