Basic Information and Instructions for Test - 3

You need to R to compute the basic output and then use it to answer the questions (in Problem 2 & 3). You need to submit the program and but answers need to be on exam paper.

Exam Materials:

Test will be based on the materials covered in class (Lecture & Home Work Problems).

Module-7 - Design of Experiments - (ANOVA) - Note that the lecture slides contains more materials than the book

Module-8 - Generalized Linear Model (Logistic Regression)

Module-9 - Regression with Time Series data

1. A farmer wants to determine the effect of five different concentrations of lime on the pH of the soil on a firm. Fifteen soil samples are to be used in the experiment, five from each of three different locations. The five soil samples from each location are then randomly assigned to the five concentrations of lime and 1 week after the lime is applied the pH of the soil is measured.

   (a) Write down the model with factors and levels (3 points).

   (b) Complete the ANOVA table below and perform a appropriate testing for concentrations ? Use $\alpha = 0.05$. (7 points)

Source	Sum of Squares	Deg of Freedom	Mean Squares	F - Stat	P -value
Concentration					
Location	0.170			5.812	
Error					
Total	1.429				

   (c) Is concentration-1 different from concentration-5 at 5% level? $T_1 = 15.5$ & $T_5 = 16.5$ (5 points)

2. The following tables provides the shipment data over the time.

t	Yt	t	Yt	t	Yt
1	65.6	7	68.3	13	141.3
2	56.7	8	79.1	14	149.6
3	79.5	9	104.2	15	177.1
4	53.4	10	104.2	16	193.6
5	59.7	11	115.4	17	238.9
6	71.1	12	86.6	18	259.2

   (1) Plot the data and fit a simple linear regression using time as the independent variable and test for positive autocorrelation at 5% level. (7.5 points)

   (2) Based on your conclusion, comment on the appropriateness of using this model and if not then try the quadratic model and test for the autocorrelation. (7.5 points)

3. On 28 January 1986 the space shuttle Challenger was destroyed in an explosion shortly after launch from Cape Kennedy. The cause of the explosion was eventually identified as catastrophic failure of the O-rings on the solid rocket booster. The failure likely occurred because the O-ring material was subjected to a lower temperature at launch (31°F) than was appropriate. The material and the solid rocket joints had never been tested at temperatures this low. Some O-ring failures had occurred during other shuttle launches (or engine static tests). The failure data observed prior to the Challenger launch is given in the data:

   a. Fit a logistic regression model to the response variable Fail. Use a simple linear regression model as the structure for the linear predictor. Interpret the coefficient of temperature.(5 points)

   b. Find a 97% confidence interval for the probability of failure when temperature is 31.(5 points)

   c. Estimate and interpret the odds ratio for temperature.(5 points)

   d. Expand the linear predictor to include a quadratic term in temperature. Is there any evidence that this quadratic term is required in the model?(5 points)