MA 69204 Statistical Software Lab
Assignment No. 10

1. The carbonation level of a soft drink beverage is affected by the temperature of the product and the filler operating pressure. Twelve observations were obtained and the resulting data are shown below:

y	2.6	2.4	17.32	15.6	16.12	5.36	6.19	10.17	2.62	2.98	6.92	7.06
x_1	31	31	31.5	31.5	31.5	30.5	31.5	30.5	31	30.5	31	30.5
x_2	21	21	24	24	24	22	22	23	21.5	21.5	22.5	22.5

    (i)   Fit a second order polynomial in two variables X_1 and X_2.
    (ii)   Find confidence intervals for the coefficients of the model.
    (iii)   Test for significance of regression coefficients.
    (iv)   Find the coefficient of determination.

2. The data on 13 subjects of approximately the same height is taken on systolic blood pressure (Y) in relation to weight (X_1) and age (X_2).

X_1	X_2	Y	X_1	X_2	Y
152	50	120	158	50	125
183	20	141	170	40	132
171	20	124	153	55	123
165	30	126	164	40	132
158	30	117	190	40	155
161	50	129	185	20	147
149	60	123			

    (a) Fit a multiple regression model.
    (b) Test for the significance of for all parameters of the model.
    (c) Set up 95% confidence intervals for all regression coefficients.
    (d) Calculate the coefficient of determination.

3. The following table presents the data concerning the percentage of conversion of n-heptane to acetylene and three explanatory variables. Fit full quadratic model in three variables to this using least squares. Examine the correlation matrix and detect multicollinearity. What statements you can make about the multicollinearity in the data? Resolve multicollinearity and fit the regression model in reduced number of variables.

Observation	Conversion of n-Heptane to Acetylene (%)	Reactor Temperature (^{0}C)	Ratio of H_2 to n-Heptane (mole ratio)	Contact Time (sec)
1	49.0	1300	7.5	0.0120
2	50.2	1300	9.0	0.0120
3	50.5	1300	11.0	0.0115
4	48.5	1300	13.5	0.0130
5	47.5	1300	17.0	0.0135
6	44.5	1300	23.0	0.0120
7	28.0	1200	5.3	0.0400
8	31.5	1200	7.5	0.0380
9	34.5	1200	11.0	0.0320
10	35.0	1200	13.5	0.0260
11	38.0	1200	17.0	0.0340
12	38.5	1200	23.0	0.0410
13	15.0	1100	5.3	0.0840
14	17.0	1100	7.5	0.0980
15	20.5	1100	11.0	0.0920
16	29.5	1100	17.0	0.0860

4. Consider the data on space shuttle Challenger O-ring failures, which have been linked to temperature. The following table gives the data on temperatures at take-off and whether or not an O-ring failed.

Failure (Y)	Temperature (X)	Failure (Y)	Temperature (X)	Failure (Y)	Temperature (X)	Failure (Y)	Temperature (X)
1	53	0	67	1	70	0	76
1	57	0	67	1	70	0	76
1	58	0	68	0	72	0	78
1	63	0	69	0	73	0	79
0	66	0	70	0	75	0	81
0	67	0	70	1	75		

Fit a standard logistic regression model to this data. Find estimates of the coefficients and also test for the significance of the regression coefficient.