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MSTL-002/S1

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

June, 2016

MSTL-002/S1 : INDUSTRIAL STATISTICS LAB SET-1

Time : 3 Hours *Maximum Marks : 50*

Note : *(i) Attempt any **two** questions.*

(ii) Solve the questions in Microsoft Excel.

(iii) Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.

(iv) Mention necessary steps, hypothesis, interpretation, etc.

(v) Symbols have their usual meanings.

1. (a) A new process of producing ball bearings is started. For monitoring the outside diameter of the ball bearings, the quality controller takes samples of four ball bearings at 10.00 A.M., 12.00 Noon, 2.00 P.M., 4.00 P.M. and 6.00 P.M. The outside diameter (in mm) of each selected ball bearing is measured. The results of the measurement over a 5-day production period are as follows :

Day	Sample Number	Time	Observations			
			X_1	X_2	X_3	X_4
Monday	1	10.00 A.M.	52	52	50	51
	2	12.00 Noon	50	53	52	53
	3	2.00 P.M.	54	51	50	52
	4	4.00 P.M.	62	65	60	62
	5	6.00 P.M.	51	52	50	53
Tuesday	6	10.00 A.M.	50	52	51	50
	7	12.00 Noon	50	54	52	51
	8	2.00 P.M.	52	51	53	50
	9	4.00 P.M.	52	53	52	55
	10	6.00 P.M.	51	51	50	51
Wednesday	11	10.00 A.M.	52	52	54	62
	12	12.00 Noon	49	48	50	50
	13	2.00 P.M.	52	53	54	49
	14	4.00 P.M.	52	51	54	51
	15	6.00 P.M.	51	51	52	52

Day	Sample Number	Time	Observations			
			X_1	X_2	X_3	X_4
Thursday	16	10.00 A.M.	50	50	51	52
	17	12.00 Noon	50	51	53	51
	18	2.00 P.M.	52	50	49	53
	19	4.00 P.M.	52	51	54	51
	20	6.00 P.M.	45	43	50	52
Friday	21	10.00 A.M.	52	54	53	50
	22	12.00 Noon	50	50	52	51
	23	2.00 P.M.	54	52	50	52
	24	4.00 P.M.	50	54	54	50
	25	6.00 P.M.	51	51	50	52

(i) Which control charts should be used to control the process mean and process variability of the process of producing ball bearings ?

(ii) Construct these charts and check whether the process is under statistical control or not.

(iii) Also plot the revised control charts, if necessary. *2+6+7*

(b) An electronics firm is manufacturing computer memory chips. Statistical quality control methods are to be used to monitor the quality of the chips produced. Any chip that does not meet specifications is classified as defective. 250 chips are sampled on each of the 30 consecutive working days. The number of defective chips found each day are recorded in the following table :

Working Day	No. of Defectives	Working Day	No. of Defectives	Working Day	No. of Defectives
1	12	11	20	21	15
2	8	12	15	22	16
3	18	13	11	23	7
4	14	14	14	24	14
5	9	15	7	25	12
6	13	16	15	26	8
7	10	17	12	27	14
8	14	18	8	28	12
9	8	19	22	29	8
10	12	20	9	30	10

(i) Construct the appropriate control chart and state whether the process is under statistical control or not.

(ii) Calculate the revised centre line and control limits to bring the process under statistical control. Also plot the revised control chart. *5+5*

2. The number of accidents on a particular stretch of highway seems to be related to the number of vehicles and the speed at which they are travelling. A city councillor has decided to examine the data statistically so that new speed laws, that will reduce traffic accidents, may be introduced. The data for 40 randomly selected days is given in the following table :

No. of Accidents	No. of Vehicles	Average Speed (km/h)	No. of Accidents	No. of Vehicles	Average Speed (km/h)
2	2123	68	13	3484	75
6	2501	74	5	2400	60
12	2722	83	12	3220	71
3	2214	63	11	3092	78
17	2840	80	12	3200	75
8	2625	71	7	2901	66
12	2723	78	4	2682	68
4	2146	60	5	2880	59
8	2682	71	2	2102	60
14	3203	82	6	2943	55
10	3100	68	8	3012	76
11	2842	72	10	3407	78
12	3002	75	12	3450	60
20	3526	88	6	2703	58
6	2405	64	3	2260	72
7	3201	65	3	2406	60
2	2318	63	4	3012	77
10	2845	72	6	3210	62
8	3017	70	4	3121	60
11	3284	70	12	3429	68

(a) Prepare a scatter matrix to get a rough idea about the relationship among the variables.

(b) Develop a multiple linear regression model.

(c) Test the significance of the fitted regression model and individual regression coefficient at 1% level of significance.

(d) Find the 99% confidence interval of the regression parameters.

(e) Check the linearity and normality assumptions for regression analysis.

5+5+5+5+5

3. The following data refers to the sales of commercial vehicles at the All India level of a leading automobile company in the country during three financial years :

Month	Year		
	2013	2014	2015
April	724	1414	1243
May	1440	2117	1818
June	1606	2199	2880
July	1656	2583	1693
August	1549	2358	2136
September	2285	3677	3707
October	1523	1823	1931
November	1856	2372	1637
December	2135	2301	1746
January	2119	2761	2638
February	2075	2110	2655
March	3850	3996	3576

(a) Compute 12-monthly moving averages and plot the graph of the moving averages with the sales data.

(b) Compute the seasonal indices for 12 months.

(c) Obtain deseasonalised values.

(d) Plot the given data along with deseasonalised values. *5+14+3+3*