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MSTL-002/S2

Post Graduate Diploma in Applied Statistics (PGDAST)

Term-End Examination

December, 2018

INDUSTRIAL STATISTICS LAB

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 hypotheses, interpretations, etc.

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1. (a) A subsidiary of an electrical company produces copper plates. The diameter specified for these plates is 3.5 cm. In order to check quality of the product, the company's quality control officer has taken a random sample of 8 plates every hour. In this manner, a total of 20 random samples of size 8 are taken and diameters of plates are recorded as follows :

Sample No.	I	II	III	IV	V	VI	VII	VIII
1	3.51	3.52	3.49	3.51	3.48	3.55	3.56	3.52
2	3.45	3.47	3.48	3.46	3.52	3.53	3.55	3.53
3	3.47	3.49	3.51	3.53	3.51	3.56	3.58	3.42
4	3.47	3.49	3.49	3.51	3.55	3.52	3.48	3.49
5	3.55	3.52	3.53	3.56	3.57	3.47	3.48	3.49
6	3.59	3.60	3.62	3.63	3.51	3.52	3.53	3.58
7	3.61	3.45	3.48	3.45	3.49	3.48	3.55	3.57
8	3.61	3.56	3.58	3.59	3.45	3.56	3.59	3.51
9	3.53	3.55	3.57	3.45	3.47	3.49	3.61	3.49
10	3.51	3.45	3.55	3.44	3.47	3.49	3.51	3.48
11	3.52	3.55	3.58	3.54	3.55	3.51	3.49	3.53
12	3.55	3.48	3.49	3.56	3.57	3.46	3.49	3.58
13	3.55	3.60	3.61	3.63	3.53	3.56	3.48	3.50
14	3.43	3.45	3.45	3.48	3.47	3.49	3.56	3.53
15	3.55	3.57	3.58	3.52	3.47	3.49	3.54	3.52
16	3.58	3.59	3.57	3.58	3.51	3.48	3.49	3.50
17	3.56	3.57	3.47	3.45	3.56	3.57	3.60	3.45
18	3.57	3.49	3.48	3.47	3.51	3.52	3.57	3.55
19	3.60	3.55	3.49	3.51	3.52	3.55	3.58	3.59
20	3.55	3.52	3.56	3.57	3.48	3.49	3.51	3.53

Draw suitable control charts for process variability and process mean and comment whether the process is under control. If not, draw the revised control charts. 15

(b) The sales turnover and the expenditure on sales promotion of a company from year 1994 to 2017 has been provided in the following table :

Year	Sales Turnover (in million ₹)	Expenditure on Sales Promotion (in million ₹)
1994	140	6
1995	150	7
1996	180	8
1997	210	8
1998	220	9
1999	235	10
2000	240	12
2001	250	14
2002	270	16
2003	300	18
2004	270	21
2005	260	19
2006	285	16
2007	250	15
2008	180	20
2009	165	15

2010	130	15
2011	110	15
2012	125	17
2013	110	15
2014	85	14
2015	80	17
2016	120	16
2017	110	20

(i) Fit a simple regression model to estimate the effect of Expenditure on sales promotion on Sales turnover.

(ii) Perform the residual analysis for the fitted model. 4+6

2. (a) A company wants to estimate the demand for a particular product by using Price of the product. Income of households and Savings of households as related factors. The company has collected data for 15 randomly selected months as follows :

Month	Demand (in units)	Price (in hundred ₹)	Income of Household (in hundred ₹)	Savings of Household (in hundred ₹)
1	50	15	100	17
2	55	13	200	25
3	62	15	300	21
4	70	13	400	23
5	77	11	500	19

6	85	9	600	25
7	68	9	700	27
8	68	13	800	29
9	75	7	900	39
10	75	7	1000	33
11	85	7	1100	35
12	100	2	1200	41
13	80	4	1300	31
14	87	2	1400	45
15	82	4	1500	39

(i) Build a regression model selecting appropriate regressors in the model.

(ii) Test significance of the fitted model at 5% level of significance and construct 95% confidence interval of the regression parameters. 15

(b) The following numbers of defects were found on articles being produced when inspected 24 items on one day :

2, 4, 7, 3, 1, 4, 8, 9, 5, 3, 7, 11, 6, 4, 9, 9, 6, 4, 3, 9, 7, 4, 7, 12

Construct a suitable chart for the above data and state whether the process is under control ? If not, draw the revised control charts. 10

3. The number of units constructed by a Real Estate Company for five years for all four quarters of the years is given in the following table :

Year	Quarter	No. of Units
2001	1	202
	2	210
	3	215
	4	212
2002	1	220
	2	225
	3	215
	4	234
2003	1	225
	2	230
	3	235
	4	225
2004	1	240
	2	245
	3	230
	4	227

2005	1	250
	2	256
	3	240
	4	235

(i) Compute seasonal indices using ratio-to-trend method. 10

(ii) Obtain deseasonalised values and then fit a linear trend line to the deseasonalised data using method of least squares. 12

(iii) Plot original data, deseasonalised values and trend values. 3