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Program : MSc Statistics-II **Sem : IV**

Practical-1 Statistical Quality Control – I

(Control Chart on Variables)

Q.1. Draw $\bar{x}$, R and S charts for the diameter in the dataset **pistonrings** for the first 25 samples. Explain your findings.

Q.2. Draw $\bar{x}$, R and S charts for the diameter in the dataset **pistonrings** for the last 15 samples after establishing control limits for the first 25 samples. Explain your findings.

Q.3. Construct a control chart for mean and range for the following data, samples of 5 beingtaken every hour:

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12
Observations	42	42	19	36	42	51	60	18	15	69	64	61
	65	45	24	54	51	74	60	20	30	109	90	78
	75	68	80	69	57	75	72	27	39	113	93	94
	78	72	81	77	59	78	95	42	62	118	109	109
	87	90	81	84	80	132	138	60	84	153	112	136

Check if the process is in control. If not, revise the limits for the future.

Q.4. PH-parts, a plastic injection company, produces high-precision vaccination syringes. The inner barrel diameter, a critical quality metric, need to be monitored using SPC tools like X-bar and R-charts. Operators record six samples hourly, and data from six hours of production as follows. State your findings.

	Sample1	**Sample2**	**Sample3**	**Sample4**	**Sample5**	**Sample6**
Hour1	5.3314	5.3399	5.3244	5.3363	5.3228	5.3181
Hour2	5.3240	5.3214	5.3142	5.3237	5.342	5.3392
Hour3	5.3263	5.3404	5.3136	5.3565	5.3387	5.357
Hour4	5.3553	5.3600	5.3171	5.3319	5.3446	5.3474
Hour5	5.3379	5.3264	5.3150	5.3134	5.3375	5.3407
Hour6	5.3432	5.3352	5.3238	5.3463	5.334	5.3205

Q.5. The following are mean and ranges of 20 samples of size 5 each. The data pertain to the overall length of a fragmentation bomb base manufactured during the war by the American store camp.

Group	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mean	0.8372	0.8324	0.8308	0.8344	0.8346	0.8332	0.834	0.8344	0.8308	0.835
Range	0.01	0.009	0.008	0.004	0.005	0.011	0.009	0.003	0.002	0.006
Group	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Mean	0.838	0.8322	0.8356	0.8322	0.8404	0.8372	0.8282	0.8346	0.836	0.8374
Range	0.006	0.002	0.013	0.005	0.008	0.011	0.006	0.006	0.004	0.006

From these data, obtain control limits for X and R charts to control the length of bomb bases to be produced in future.

Q.6. From the following data showing values of sample mean and range for 10 samples eachof 6, calculate the values for central line and the control limits for mean and range chart.Comment on the state of control of the mean chart. Can the process be said to be in a state of control regarding the variations inequality of the manufactured products?

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

Q.7. Construct a control chart for mean and range of the following data on the basis of fuses, sample of 4 being taken every hour:

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Observation	27	30	21	40	51	33	30	35	20	22	34	32	34	28	44
	23	17	44	21	34	30	22	48	34	50	22	48	32	30	32
	36	27	22	29	17	28	18	20	15	45	36	32	28	17	22
	24	32	28	24	10	12	22	47	42	41	44	33	48	23	41

Sample No.	16	17	18	19	20	21	22	23	24	25
Observation	26	38	26	42	30	23	28	25	30	38
	42	40	28	38	32	44	34	29	38	27
	35	51	34	52	39	48	39	40	44	39
	28	32	39	36	45	33	44	33	32	22

Comment on the state of control.

Q.8. A machine is set to deliver packets of a given weight. 10 samples of size 5 each were recorded as follows: 15, 17, 15, 18, 17, 14, 18, 15, 17 and 16. The mean range in these samples is 7.4. Construct a mean chart. Are all the sample points lying within the controllimits?

Q.9.	A drilling machine bores holes with a mean diameter of 0.523 cm and a standard deviation of 0.0032 cm. Calculate 2 – sigma and 3 – sigma upper and lower controllimits for means of samples 4 and prepare a control chart.