KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SPECIAL EXAMINATION

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE APPLIED STATISTICS AND BACHELOR OF SCIENCE ACTURIAL SCIENCE

SECOND SEMESTER 2021/2022

(JULY, 2022)

MATH 342: QUALITY CONTROL METHODS

STREAM: Y3 S2 **TIME: 2 HOURS**

DAY: MONDAY, 3.00 PM – 5.00 PM **DATE: 25/07/2022**

INSTRUCTIONS:

1. Do not write anything on this question paper.
2. Answer question one (Compulsory) and any other TWO Questions.

QUESTION ONE-30 MARKS

a) Suppose Respiratory Masks are packaged in boxes of either 25 or 50 per box. At each 30 minute interval during a shift, a box is randomly chosen and the number of defectives in the box determined. The data is given below;

SHIFT	SAMPLE SIZE	NO DEFECTIVES	SHIFT	SAMPLE SIZE	NO DEFECTIVES
1.	400	3	11.	400	7
2.	575	7	12.	400	3
3.	400	1	13.	625	6
4.	800	7	14.	800	5
5.	475	2	15.	800	4
6.	575	0	16.	300	7
7.	400	8	17.	475	9
8.	625	1	18	800	9
9.	775	10.	19.	750	9
10.	425	8	20.	475	2

Is the process under control? [15 Marks]

b) The table below shows the width of a product taken at 20 time points. Construct an $\overline{X}$ and R chart for the same and determine whether the process is under control.

[15 marks]

Time Points	Widths in Cms				
1.	2.000	1.988	1.975	1.994	1.991
2.	2.007	1.988	2.002	1.978	2.012
3.	1.987	1.983	2.006	2.019	2.021
4.	1.989	1.997	1.976	2.007	1.989
5.	1.997	2.018	1.999	1.990	2.003
6.	1.983	1.972	2.002	1.991	1.997
7.	1.966	1.982	1.995	2.020	2.008
8.	2.004	1.998	2.011	1.991	1.972
9.	2.009	1.994	2.020	2.000	2.006
10.	1.991	1.989	2.000	2.016	2.037
11.	2.004	1.980	1.998	1.994	2.006
12.	1.988	1.991	2.003	1.997	1.985
13.	1.996	2.005	1.996	2.008	2.007
14.	1.999	1.984	1.988	2.011	2.005
15.	2.018	2.009	2.023	2.010	1.993
16.	2.025	2.022	2.035	2.013	2.020
17.	2.002	1.969	2.018	1.984	1.990
18.	1.988	2.031	1.978	1.987	1.992
19.	2.011	1.976	1.998	2.023	1.998
20.	1.998	2.003	2.016	1.996	2.009

QUESTION TWO-20 MARKS

The Deming Philosophy is an important framework for implementing quality and productivity improvement. State and describe any 10 of his 14 points of management.

QUESTION THREE-20 MARKS

The Data below shows deviations from nominal diameter for holes drilled in a Carbon Fiber material used in aerospace manufacturing. The vales are deviations from nominal in ten-thousands of an inch.

Sample No	X_1	X_2	X_3	X_4	X_5
1.	-30	+50	-20	+10	+30
2.	0	+50	-60	-20	+30
3.	-50	+10	+20	+30	+20
4.	-10	-10	+30	-20	+50
5.	+20	-40	+50	+20	+10

6.	0	0	+40	-40	+20
7.	0	0	+20	-20	-10
8.	+70	-30	+30	-10	0
9.	0	0	+20	-20	+10
10.	+10	+20	+30	+10	+50
11.	+40	0	+20	0	+20
12.	+30	+20	+30	20	+40
13.	+30	-30	0	+10	+10
14.	+30	-10	+50	-10	-30
15.	+10	-10	+50	-10	0
16.	0	0	+30	-10	0
17.	+20	+20	+30	+30	-20
18.	+10	-20	+50	+30	+10
19.	+50	-10	+40	+20	0
20.	+50	0	0	+30	+10

Set up $\bar{x}\ and\ s$ charts on the process. Is the process in Statistical control?

QUESTION FOUR-20 MARKS

The thickness of a printed Circuit Board is an important Quality parameter. Data on board thickness (in inches) are given below for 15 samples of three boards each.

Sample number	**X_1**	**X_2**	**X_3**
1	0.0629	0.0636	0.0640
2.	0.0630	0.0631	0.0622
3.	0.0628	0.0631	0.0633
4.	0.0634	0.0630	0.0631
5.	0.0619	0.0628	0.0630
6.	0.0613	0.0629	0.0634
7.	0.0630	0.0639	0.0625
8.	0.0628	0.0627	0.0622

9.	0.0623	0.0626	0.0633
10.	0.0631	0.0631	0.0633
11.	0.0635	0.0630	0.0638
12.	0.0623	0.0630	0.0630
13.	0.0635	0.0631	0.0630
14.	0.0645	0.0640	0.0631
15.	0.0619	0.0644	0.0632

Estimate process capability using $\bar{x}\ and\ R$ charts.

QUESTION FIVE-20 MARKS

Suppose that a double sampling plan with n_1=59, c_1=1 and n_2=64, c_2=3 is being used for receiving inspection. Find the probability for acceptance, p_a for fraction defective points $p = 0.01, p = 0.02, p = 0.03, p = 0.04\ and\ p = 0.05$.

QUALITY CONTROL TABLE

Sample Size = m	A_2	A_3	d_2	D_3	D_4	B_3	B_4
2	1.880	2.659	1.128	0	3.267	0	3.267
3	1.023	1.954	1.693	0	2.574	0	2.568
4	0.729	1.628	2.059	0	2.282	0	2.266
5	0.577	1.427	2.326	0	2.114	0	2.089
6	0.483	1.287	2.534	0	2.004	0.030	1.970
7	0.419	1.182	2.704	0.076	1.924	0.118	1.882
8	0.373	1.099	2.847	0.136	1.864	0.185	1.815
9	0.337	1.032	2.970	0.184	1.816	0.239	1.761
10	0.308	0.975	3.078	0.223	1.777	0.284	1.716
11	0.285	0.927	3.173	0.256	1.744	0.321	1.679
12	0.266	0.886	3.258	0.283	1.717	0.354	1.646
13	0.249	0.850	3.336	0.307	1.693	0.382	1.618
14	0.235	0.817	3.407	0.328	1.672	0.406	1.594
15	0.223	0.789	3.472	0.347	1.653	0.428	1.572
16	0.212	0.763	3.532	0.363	1.637	0.448	1.552
17	0.203	0.739	3.588	0.378	1.622	0.466	1.534
18	0.194	0.718	3.640	0.391	1.608	0.482	1.518
19	0.187	0.698	3.689	0.403	1.597	0.497	1.503
20	0.180	0.680	3.735	0.415	1.585	0.510	1.490
21	0.173	0.663	3.778	0.425	1.575	0.523	1.477
22	0.167	0.647	3.819	0.434	1.566	0.534	1.466
23	0.162	0.633	3.858	0.443	1.557	0.545	1.455
24	0.157	0.619	3.895	0.451	1.548	0.555	1.445
25	0.153	0.606	3.931	0.459	1.541	0.565	1.435