CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE, BACHELOR OF EDUCATION & BACHELOR OF ARTS

MATH 342: QUALITY CONTROL METHODS

STREAMS: BSC, BED, BA **TIME: 2 HOURS**

DAY/DATE: TUESDAY 05/12/2017 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

(a) Distinguish the following terms

(i) Assignable and chance variation [2 marks]

(ii) Type I and Type II errors [2 marks]

(b) Find the probability of acceptance in a single sampling plan with $n = 100\ and\ c = 5$. Take the lot fraction defective = 0.05. [5 marks]

(c) Outline three broad categories of statistical quality control. [6 marks]

(d) Control charts for $\bar{X}$ and R are maintained on a certain dimension of a manufactured part, measured in inches. The subgroup size is 4. The values of $\bar{X}$ and R are computed for each subgroup, after 25 subgroups

$\sum \bar{X} = 398.75\ \ and\ \ \sum R = 7.17$

Compute the values of the 3-sigma limits for the $\bar{X}$ and R charts and estimate the value of σ on the assumption that the process is in statistical control. [6 marks]

(e) Give $n = 5$and $k = 2$, determine the probability of detecting a shift to $\mu = \mu_o + 2\sigma$ on the first sample solutions the shift. [3 marks]

(f) The sample fraction defective for 21 sample of size 5 are given below

0.22	0.46
0.33	0.31
0.24	0.24
0.20	0.22
0.18	0.22
0.24	0.29
0.24	0.31
0.29	0.21
0.18	0.26
0.27	0.24
0.31	

Calculate the control limit for the p-chart. [6 marks]

QUESTION TWO (20 MARKS)

(a) Outline three approaches to lot sentencing. [3 marks]

(b) In a double sampling plan, the parameters, are $n_1 = 50, C_1 = 2, n_2 = 90$and $C_2 = 6$. Consider a lot with exactly 10% defectives. Find

(i) The probability of acceptance on the 1st sample. [4 marks]

(ii) The probability of acceptance on the second sample. [8 marks]

(iii) The probability of acceptance. [3 marks]

(c) Suppose the process average fraction non conforming shifted to 0.15. What is the probability that the shift would be detected on the 1st subsequent sample. [2 marks]

QUESTION THREE (20 MARKS)

(a) Briefly describe double sampling plan. [9 makers]

(b) The following data was obtained over a 25 day period to initiate $\bar{X}$ and R chart for a quality characteristic of a manufactured product. The subgroup size was 4.

Sample No.	$\bar{X}$	R	Sample No.	$\bar{X}$	R
1	15.91	0.19	14	15.91	0.37
2	15.99	0.27	15	16.05	0.31
3	15.92	0.17	16	15.99	0.29
4	15.93	0.46	17	15.86	0.33
5	15.98	0.47	18	16.01	0.34
6	16.03	0.20	19	15.98	0.28
7	15.96	0.46	20	16.02	0.20
8	15.93	0.20	21	16.00	0.23
9	15.96	0.21	22	15.90	0.16
10	15.83	0.30	23	15.86	0.32
11	15.99	0.29	24	15.94	0.15
12	15.96	0.43	25	15.94	0.30
13	15.83	0.24			

Required:

(i) Obtain control limit for the $\bar{X}$and R control chart. [8 marks]

(ii) Estimate standard deviation (σ) [2 marks]

QUESTION FOUR (20 MARKS)

(a) Summarize the acceptance sampling procedure on a flow chart. [5 marks]

(b) The following table give the number of missing rivets of the final inspection of aircrafts

Airplane	No. of missing rivets	Airplane No.	No. of missing rivets
901	9	914	16
902	28	915	23
903	7	916	12
904	22	917	21
905	10	918	11
906	9	919	8
907	11	920	15
908	14	921	11
909	9	922	19
910	9	923	14
911	15	924	16
912	25	925	8
913	9		

Required:

(i) Find $\bar{C}$ the average number of missing rivets per plane.

(ii) Construct a C – chart for these data. Does the process appear to be in control? If not, assume that assignable causes can be found for all points outside the control limits and calculate the revised control limit. [15 marks]

QUESTION FIVE (20 MARKS)

Consider the data shown below

Sample No.	x_1	x_2	x_3	x_4	Sample No.	x_1	x_2	x_3	x_4
1	6	9	10	15	11	18	12	14	16
2	10	4	6	11	12	6	13	19	11
3	7	8	10	5	13	16	19	13	15
4	8	9	6	13	14	7	13	10	12
5	9	10	7	13	15	11	7	10	16
6	12	11	10	10	16	15	10	11	14
7	16	10	18	19	17	19	8	12	10
8	7	5	10	4	18	15	7	10	11
9	9	7	18	12	19	8	6	19	12
10	15	16	10	13	20	14	15	12	16

Required:

(a) Obtain control limits for the $\bar{X}$ and R charts. [10 marks]

(b) Does the process seem to be in statistical control? If necessary, revise the trial control limits. [10 marks]
