CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE, ART AND EDUCATION

MATH 342: QUALITY CONTROL METHODS

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

DAY/DATE: TUESDAY 06/04/2021 **8.30 A.M. – 10.30 A.M.**

INSTRUCTION: Answer Question One and any other TWO Questions

QUESTION ONE (30 MARKS)

(a) Briefly outline two approach to the management of quality of manufactured goods in industry. [4 marks]

(b) Outline 3 approaches to lot sentencing in quality control. [3 marks]

(c) Samples of size n=5 are taken from a manufacturing process at regular intervals. A quality characteristic is measured and X and S values calculated for each sample. After 30 subgroups, we have

$$\sum_{i=1}^{30} \bar{X}_i = 58395 \quad and \quad \sum_{i=1}^{30} S_i = 1516$$

Required

i. Compute the control limits for $\bar{X}$ and S charts [5 marks]

ii. Estimate the value of sigma assuming the process is operating in statistical control [1 mark]

iii. Assuming that the distribution generated by process is approximately normal, what percentage of the product meets specifications of 2000 ±150 [4 marks]

(d) Find the probability of acceptance in a single sampling plan with n=10 and c=5. Assuming the lot fraction defective is 5%. [5 marks]

(e) Summarize the acceptance samples procedure on a flow chart [8 marks]

QUESTION TWO (20 MARKS)

(a) A sample of 5 bars from each of the last 10 days is sent for a chemical analysis of the calorie content. The results are shown below. Does it appear that there are any days where the calorie count is out of control?

Sample	Calorie Count				
	1	2	3	4	5
1	426	406	418	431	432
2	421	422	415	412	411
3	425	420	406	409	414
4	424	419	402	400	417
5	421	408	423	410	421
6	427	417	408	418	422
7	422	417	426	435	426
8	419	417	412	415	417
9	417	432	417	416	422
10	420	422	421	415	422

Required

Develop an appropriate control chart ($\bar{X}$- and R- Chart) and analyze your findings.

[10 marks]

(b) The Early Morning Delivery Service guarantees delivery of small packages by 10:30 A.M. Of course, some of the packages are not delivered by 10:30 A.M. For a sample of 200 packages delivered each of the last 15 working days, the following number of packages were delivered after the deadline:

4 9 14 2 13 9 5 9

3 4 3 3 8 4 3

Determine

(i) The mean proportion of packages delivered after 10:30 A.M.

(ii) The control limits for the proportion of packages delivered after 10:30 A.M. Were any of the sampled days out of control?

(iii) If 10 packages out of 200 in the sample were delivered after 10:30 A.M. today, is this sample within the control limits? [10 marks]

QUESTION THREE (20 MARKS)

(a) Outline Advantages of quality control [5 marks]

(b) An X chart is used to control the mean of a quality characteristic. It is known that sigma=6.0 and n=4. The center line=200, UCL=209 and LCL=191. If the process mean shift to 188, find the probability that shift is detected on the first subsequent sample. [5 marks]

(c) The data below represents the number of nonconformities per a 1000 meters in telephone cable. Assuming that assignable causes can be found for point that plot out of control.

Sample No	No. of Nonconformities	Sample No	No. of Nonconformities	Sample No	No. of Nonconformities
1	1	9	0	16	8
2	1	10	19	17	3
3	3	11	24	18	6
4	7	12	6	19	7
5	8	13	9	20	4
6	10	14	11	21	9
7	5	15	15	22	20
8	13				

Required

Obtain the control limits for 2500 meters of cable [10 marks]

QUESTION FOUR (20 MARKS)

(a) Outline the merits of acceptance sampling [5 marks]

(b) A double sampling plan, has parameters n_1=50, c_1=2, n_2=100 and c_2=8. Consider a lot with exactly 5% defective. Compute;

(i) The probability of acceptance on the 1st sample [5 marks]

(ii) The probability of acceptance on the 2nd sample [8 marks]

(iii) The probability of acceptance [2 marks]

QUESTION FIVE (20 MARKS)

(a) Lahey Motors specializes in selling cars to buyers with a poor credit history. Listed below is the number of cars that were repossessed from Lahey customers because they did not meet the payment obligations over the last 36 months.

6	5	8	20	11	10	9	3	9
15	12	4	11	9	9	6	18	6
9	7	13	7	11	8	11	13	6
13	5	5	8	10	11	9	8	14

Required

Develop a *c*-bar chart for the number repossessed. Were there any months when the number was out of control? Write a brief report summarizing your findings [10marks]

(b) Compute the C_{pk} measure of process capability for the following machine and interpret the findings. What value would you have obtained with the C_p measure? Machine Data:

USL = 80

LSL =50

Process δ= 5

Process μ=60

[10 marks]
