CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS AND STATISTICS AND BACHELOR OF SCIENCE

MATH 342: QUALITY CONTROL METHODS

STREAMS: BSC **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 30/08/2023 **11.30 A.M. – 1.30 P.M**

INSTRUCTIONS:

- **Answer ALL questions.**

QUESTION ONE (30 MARKS)

a) Outline the five **(5)** advantages of statistical quality control [5 marks]

b) Samples of $n=5$ are taken from a manufacturing process at regular intervals. A quality characteristic is measured and $\bar{X}$ and S calculated for each sample. After 30 subgroups, we have; $\sum_{i=1}^{30} \bar{X}_i = 58{,}935$ and $\sum_{i=1}^{30} S_i = 1{,}516$

Required

i. Compute the control limits for the $\bar{X}$ and S charts [6 marks]

ii. Estimate the value of sigma (σ) assuming the process is operating in statistical control [2 marks]

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

c) Summarize the quality control techniques on a flow chart [8 marks]

d) Sam's Supermarkets test its checkout clerks by randomly examining the printout receipts for scanning errors. The following numbers are the number of errors on each receipt for the month January 2021.

2	3	1	2	2	1	3	2
2	1	2	2	1	0	0	

Construct a control chart for the process and comment on whether the process is in control [5 marks]

QUESTION TWO (20 MARKS)

(a) Briefly describe the double sampling plan [7marks]

(b) A double sampling plan, has parameters n_1=50, c_1=2, n_2=90 and c_2=6. Consider a lot with exactly 10% defective. Find;

(i) the probability of acceptance on the 1st sample [3marks]
(ii) the probability of acceptance on the 2nd sample [8marks]
(iii)the probability of acceptance [2marks]

QUESTION THREE (20 MARKS)

a) A control chart for a fraction non-conforming is to be established using center line p=0.10. What sample size is required if we wish to detect a shift in the process fraction non-conforming to 0.16 with p=0.50? [6marks]

b) The following data obtained over a 24-day period to initiate $\vec{X}$ and R control charts for a quality characteristics of a certain manufactured product that had required substantial amount of rework. All the figures apply to product made on a single operator. The subgroup size was 5.

Subgroup Number	$\vec{X}$	R	Subgroup Number	$\vec{X}$	R
1	34.5	3	13	35.4	8
2	34.2	4	14	34.0	6
3	31.6	4	15	37.1	5
4	31.5	4	16	34.9	7
5	35.0	5	17	33.5	4
6	34.1	6	18	31.7	3
7	32.6	4	19	34.0	8
8	33.8	3	20	35.1	4
9	34.8	7	21	33.7	2
10	33.6	8	22	32.8	1
11	31.9	3	23	33.5	3
12	38.6	9	24	34.2	2

Required:

(i) Determine central lines and trial control limits for the $\vec{X}$ and R charts
(ii) Estimate sigma ($\boldsymbol{\sigma_R}$) [14marks]
