

CHUKA



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**EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE, BACHELOR OF EDUCATION ARTS**

MATH 342: QUALITY CONTROL METHODS

STREAMS: BSC, BED, BA

TIME: 2 HOURS

DAY/DATE: MONDAY 10/12/2018

2.30 PM - 4.30 PM

INSTRUCTIONS:

ANSWER QUESTION ONE COMPULSORY AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- (a) Distinguish between assignable and chance variation and cite an example [4 marks]
- (b) Control charts of \bar{X} , R and S are to be maintained on samples of size $n=10$ from a normally distributed process where it is known that the population mean and variance are known to be $\mu=80$ and $\sigma^2=100$ respectively. Find the center line and control line for each of these 3 charts. [9 marks]
- (c) Sample of size $n=6$ item are taken from a manufacturing process at regular interval. A normally distributed quality characteristic is measured and \bar{X} and S values are calculated for each sample. After 50 subgroups have been analysed the following results were obtained.

$$\sum_{i=1}^{50} \bar{X}_i = 1000; \sum_{i=1}^{50} S_i = 75$$

Compute the control limit for the \bar{X} and S charts. [8 marks]

(d) A double samples plan has $n_1=25$, $n_2=50$, $C_1=1$, $C_2=3$. Compute the probability of acceptance of a 4% defective lot. [5 marks]

(e) The number of non-conformities observed in the final inspection of goods has be given as in the table below

Sample No	No. of goods inspected	Total No. of non-conformity
1	3	20
2	1	10
3	4	30
4	2	10

Calculate the control limits and determine whether the process is in statistical control. [4 marks]

QUESTION TWO (20 MARKS)

(a) Briefly explain 3 classifications of statistical quality control. [6 marks]

(b) Manufacturing is initiated on a new feed pipe to be used as a water line in a particular heater. To monitor the length of the pipe, \bar{X} and R-charts were initiated based on 25 sub-groups.

$$\sum \bar{X} = 500 \wedge \sum R = 51.474$$

What should be the $3-\sigma$ control limit foer the \bar{X} and R-charts [9 marks]

(c) The number of defects on 18 items are given below

2	0	0	1	4	0	0	1	2
2	0	0	1	2	3	0	2	1

Calculate the control limits [5 marks]

QUESTION THREE (20 MARKS)

(a) Outline four advantages of statistical quality control. [4 marks]

(b) The following data was obtained over a 25-day period to initiate $\bar{X}-i$ chart for a quality characteristic of a manufactured product. The subgroup size was 5

Sample No	\bar{X}_i	R_i	Sample No	\bar{X}	R_i
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1	73.99	0.039	14	73.998	0.029
2	74.006	0.016	15	74.010	0.038
3	73.997	0.021	16	74.001	0.019
4	74.001	0.026	17	74.008	0.036
5	74.007	0.018	18	74.003	0.022
6	73.998	0.021	19	74.003	0.026
7	74.009	0.021	20	73.996	0.024
8	74.000	0.033	21	74.000	0.012
9	74.002	0.019	22	73.997	0.030
10	74.002	0.025	23	74.004	0.014
11	74.005	0.022	24	73.998	0.017
12	73.998	0.035	25	74.994	0.008
13	74.001	0.011			

Required:

- (i) Obtained control limits for \bar{X} and R charts [9 marks]
- (ii) Estimate δ (standard deviation) [2 marks]
- (c) Find the probability of acceptance in a single plan with $n=80$ and $C=3$. Assume the lot fraction defective is 1% [5 marks]

QUESTION FOUR (20 MARKS)

- (a) In a double sampling plan the parameters are $n_1=50$, $C_1=2$, $n_2=100$ and $C_2=6$. Consider a lot with exactly 5% defective. Find:
- (i) The probability of acceptance on the first sample [4 marks]
- (ii) The probability of acceptance on the second sample [10 marks]
- (iii) The probability of acceptance [1 mark]
- (b) The sample fraction defective for 27 samples of size 50 are given below
- 0.10 0.20 0.30 0.18 0.12 0.34 0.26 0.24 0.10
 0.18 0.12 0.14 0.32 0.18 0.28 0.20 0.36 0.24
 0.14 0.24 0.30 0.16 0.20 0.08 0.16 0.26 0.22
- Calculate the control limit for the P-chart. [5 marks]

QUESTION FIVE (20 MARKS)

- (a) A control chart indicates that the current process fraction non-conforming is 0.01. if 40 items are inspected each day, what is the probability of detecting a shift in the fraction non-conforming to 0.02 on the first day after the shift. [7 marks]
- (b) Briefly describe
- (i) The single sampling plan [5 marks]
- (ii) The double sampling plan [8 marks]
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