



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

THIRD YEAR SPECIAL /SUPPLEMENTARY EXAMINATION FOR
BACHELOR OF SCIENCE IN STATISTICS AND PROGRAMMING

SMA 366: QUALITY CONTROL METHODS

DATE: 19/01/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

Answer question one and any other two

QUESTION ONE (30 MARKS)

- a) Distinguish the following terms as used in statistical quality control
- Quality assurance and Quality management
 - Producer's risk and consumer's risk
 - Assignable causes of variations and common causes of variations (6 marks)
- b) Highlight three advantages of acceptance sampling in quality control process (3 marks)
- c) A quality control officer in Walts chain stores claims that 75% of the peanut butter in the store are affected by campylobacter bacteria. A random sample of 50 cans showed that 20 of them were affected. Are these sample results consistent with the claim of the officer? Use $\alpha = 0.01$ (4 marks)
- d) The following data shows the number of defectives and items sampled

Sample no.	1	2	3	4	5	6	7	8	9	10
Range	210	215	200	214	210	208	211	202	204	220
Mean	7	4	8	5	7	4	8	4	7	9

Construct the fractional defective chart and commend whether the process is under control or not (8 marks)

- e) By citing examples distinguish between the control charts for variables and control charts for attributes. (4 marks)
- f) Highlight Six functions of Kenya Bureau of Standards (KEBS) (6 marks)

QUESTION TWO (20 MARKS)

- a) A manufacturer of electric gadgets has known from experience that 5% of the gadgets produced are defective, if random sample of 250 gadgets is examined determine the probability that the proportion defective is between 0.10 to 0.35 (5 marks)
- b) In a random sample of 100 items taken from machine *A*, 60 are found to be defective. In another sample of 200 items taken from machine *B*, 100 items are found to be defective. Do the data reveal significant difference between the two machines as far as the quality output is concerned? (5 marks)
- c) Given $N=500$, $n=150$ and $c=3$ construct OC curve for $0.01 \leq p \leq 0.06$ based on Poisson distribution (10 marks)

QUESTION THREE (20 MARKS)

- a) Discuss briefly the meaning of single, double and multiple acceptance sampling plans (6 marks)
- b) Highlight four advantages of Cusum control charts over Shewart control charts (4 marks)
- c) Highlight four quality characteristics of a quality control officer (4 marks)
- d) The following information relates to the lifespan electric bulbs manufactured by two companies A and B:

	Company A	Company B
Mean life (in hours)	1550	1385
Standard deviation (in hours)	85	65
Sample size	150	200

Which brand of bulbs would you recommend for a client taking a risk of 5%? (6 marks)

QUESTION FOUR (20 MARKS)

- a) During an examination of equal length of a piece of cloth the following number of defects were observed per sample; 1,3,4,2,5,6,7,4,3,5,4,2,3.

Draw the control chart for the number of defects and commend on the state of the process

(6 marks)

- b) Discuss any five dimensions of quality characteristics in production industry (10 marks)

- c) $\bar{X}$ -Control chart with 3-sigma control limits has the parameters;

UCL=104, CL=100, ICL=96 and $n=5$. Suppose the measured characteristic is normally distributed $N(\mu, \sigma)$ with a true average 98 and $\sigma = 8$. Determine the probability that the control chart will raise an out of control alarm after a maximum of 3 samples (4 marks).

QUESTION FIVE (20 MARKS)

- a) The mobile phones batteries produced by a certain machines were examined and the following table shows the distribution of defective batteries per sample

0	1	2	3	4	5	6	7	8	Total
11	7	27	56	70	54	22	8	1	256

Fit a binomial distribution and hence determine the expected

i. Frequencies

ii. Mean

iii. Standard deviation

(8 marks)

- b) The table below shows the mean and range for 10 samples each of size 5

Sample no.	1	2	3	4	5	6	7	8	9	10
Range	11.4	12.0	11.0	11.8	11.2	9.8	10.6	9.8	10.8	10.2
Mean	8	5	9	6	7	5	9	5	8	9

By using mean and range charts determine whether the process is in control

(6 marks)

- c) Write down the R script for constructing;

i. $\bar{X}$ & R Control Charts, 3σ

ii. $\bar{X}$ & S Control Charts, 3σ

iii. CUSUM and Exponentially weighted moving average.

(6 marks)