MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

FOURTH YEAR SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS AND STATISTICS)

SMA 366: QUALITY CONTROL METHODS

DATE: 24/7/2019 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Answer question <u>one</u> and any other <u>two</u>

QUESTION ONE (30 MARKS)

a) Distinguish the following terms as used in statistical quality control

i. Sampling and Census

ii. Control limits and Tolerance limits

iii. Process control and product control (6 marks)

b) A quality control officer in NCPB store claims that 70% of the cereals in the store are bad. A random sample of 50 bags showed that 35 of them were bad. Are these sample results consistent with the claim of the officer? Use $\alpha = 0.05$ (4 marks)

c) 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	7	4	8	5	7	4	8	4	7	9

By using mean and range charts determine whether the process is in control (6 marks)

d) By citing examples distinguish between the control charts for variables and attributes (4 marks)

e) During an examination of equal length of a piece of cloth the following number of defects were observed; 2,3,4,0,5,6,7,4,3,2.

Draw the control chart for the number of defects and commend on the state of the process (6 marks)

f) Distinguish between the random variation and assignable variations by giving examples (4 marks)

QUESTION TWO (20 MARKS)

a) Distinguish between the producers risk and consumer's risk (4 marks)

b) 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)

c) 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? (6marks)

QUESTION THREE (20 MARKS)

a) Discuss briefly the meaning of single, double and multiple acceptance sampling plans (6 marks)

b) Highlight three advantages of Cusum control charts over Shewart control charts (6 marks)

c) The following shows the thickness of steel tubes, whose target thickness (μ_0) is 10 cm. construct the Cusum chart using the data and commend on the process status.

Sample No.	1	2	3	4	5	6	7	8	9	10
X in cm	9.45	7.99	9.29	11.66	12.16	10.18	8.04	11.46	9.20	10.34
Sample No.	11	12	13	14	15	16	17	18	19	20
X in cm	9.03	11.47	10.51	9.40	10.08	9.37	10.62	10.31	8.52	10.84
Sample No.	21	22	23	24	25	26	27	28	29	30
X in cm	10.90	9.33	12.29	11.50	10.60	11.08	10.38	11.62	11.31	10.52

(8 marks)

QUESTION FOUR (20 MARKS)

a) A manufacturer of electric gadgets has known from experience that 3% of the gadgets produced are defective, if random sample of 300 gadgets is examined determine the probability that the proportion defective is between 0.025 to 0.035 (4 marks)

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

c) Highlight six quality characteristics of a quality control officer (6 marks)

QUESTION FIVE (20 MARKS)

a) Differentiate the following terms as apply in social research.
   i. Type I and Type II error
   ii. Two tailed and one tailed test
   iii. Descriptive and inferential statistics
   iv. Null hypothesis and Alternative hypothesis (8 marks)

b) The following information relates to the lifespan electric bulbs manufactured by two companies A and B:

	Company A	Company B
Mean life (in hours)	1300	1288
Standard deviation (in hours)	82	93
Sample size	100	100

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

c) Two different types of machines A and B products had the following number of defective items per run

Runs	1	2	3	4	5	6	7
Defectives from machine A	8	12	13	9	3	-	-
Defectives from machine B	10	8	12	15	6	8	11

Determine whether the two machines differ significantly with regard to their effect in producing defective items at $\alpha = 5\%$ (6 marks)