MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2023/2024

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES

BACHELOR'S OF SCIENCE IN APPLIED STATISTICS WITH COMPUTING

THIRD YEAR SECOND SEMESTER

COURSE CODE: STA 3235-1

COURSE TITLE: STATISTICAL QUALITY CONTROL AND ACCEPTANCE SAMPLING

DATE: **TIME:**

INSTRUCTIONS:
Attempt Question one and any other Two Questions

Show your workings as marks will be awarded for correct working.

Question 1

a. Differentiate the following terms as used in statistical quality control.
   i. 100% Inspection and Sample Inspection. **(2 marks)**
   ii. Producer risk and Consumer risk. **(2 marks)**

b. In a single probability plan N=500, n=50 and c=3, if the product quality shows that there is a 1.5% chance of having a defective item in the lot, calculate the Average Outgoing Quality (AOQ). **(4 marks)**

c. The data below shows the results of 10 samples taken from production line of a certain production. Use it to construct and X-bar chart with R as the measure of variation hence comment on the control status of the process. **(6 marks)**

Sample Number	Observation		
1	630	637	641
2	631	632	623
3	629	632	634
4	635	631	632
5	620	629	631
6	614	630	635
7	661	640	626
8	629	628	623
9	624	627	634
10	632	632	634

d. What **Rectification Inspection** and what is its goal? **(2 marks)**

e. Design specifications require that a key dimension on a product measure 101±16 units. A process being considered for producing this product has a standard deviation of four units.
   i. What can you say (quantitatively) regarding the process capability? Assume that the process is centered with respect to specifications. **(2 marks)**
   ii. Suppose the process average shifts to 96. Calculate the new process capability. **(2 marks)**

Question 2

a. The data below shows the observation of 15 samples of size 6 each collected from a production line. Use the data to construct a Cusum chart that would detect a shift of 0.4 units in the production center, hence comment on the control status of the process. (***only draw the upper control line).*** **(10 Marks)**

Sample Number						
1	0.8	0.7	0.9	0.8	1.2	1.1
2	0.7	0.8	1.1	1.1	1.2	0.8
3	0.6	0.5	0.8	0.7	0.8	1
4	1.1	1.4	1.3	0.7	1.6	1.4
5	1	1.2	1.1	0.9	0.8	0.7
6	0.9	1.1	0.7	0.9	0.8	0.9
7	0.7	0.7	0.8	0.7	0.7	0.7
8	0.8	1	1.1	1	0.8	0.9
9	1	0.7	0.8	0.9	0.9	0.9
10	0.9	0.9	0.8	0.7	0.9	1
11	0.9	0.8	1	0.7	0.8	0.7
12	1	0.8	0.8	0.7	0.7	1
13	0.8	0.7	0.8	0.7	0.7	0.8
14	0.9	0.8	0.9	0.8	0.7	0.9
15	1	0.8	0.9	0.8	0.7	0.7

b. Assume that the process in (a) is in control state and a customer request the company to produce for him products with specifications of 1±0.4, what is the actual process capability to produce such products? **(3 marks)**

c. Based on the index computed in (b) is the production process centered around the required specification and if not by how much is it off specification. **(2 marks)**

Question 3

a. A single sampling plan is defined as N=2000, n=40, c=3. There is a 0.1% chance that a product is defective in a lot of products supplied by the company.
   i. Explain how this sampling plan works. **(3 marks)**
   ii. Determine the probability of accepting lot of products in this plan. **(4 marks)**
   iii. Determine the probability of rejection a sample in this plan. **(1 mark)**
   iv. Calculate the Average Outgoing Quality of these products and comment on the results. **(3 marks)**

b. Give **four** reasons why acceptance sampling may be preferred over 0% inspection as a lot sentencing technique. **(4 marks)**

Question 4

a. A double sampling plan is given as N=1500, n_1=48, c_1=2, n_2 =130, c_2= 4. If a lot has 0.5% chance of having a defective item, calculate the probability of accepting this lot based on this sampling plan. **(7 marks)**

b. The following data refers to usual defects found at inspection of the first 10 samples of size 50 each. Use the data to construct np and c chart, hence comment on the control status of the process based on each chart. **(8 marks)**

Sample Number	1	2	3	4	5	6	7	8	9	10
No. of defectives	2	1	1	3	2	3	4	2	2	0