MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
(MMUST)

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
(MAIN CAMPUS)

MAIN EXAMINATION

FOURTH YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE

OF

BACHELOR OF SCIENCE (SST)

COURSE CODE: STA 448

COURSE TITLE: SEQUENTIAL MODELS AND ANALYSIS

DATE: Friday 29th April, 2022   **TIME:** 08:00 - 10:00 Hrs

INSTRUCTIONS TO CANDIDATES:

1. *Answer Question ONE and any other **TWO** Questions in*
2. *In each question, show your **working clearly***
3. *There will be marks for proper working even if the answer is wrong*
4. *Calculators and mathematical tables (SMP) may be used*

DURATION: 2 hours

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE COMPULSORY (30 MARKS)

a) Describe the Wald's sequential probability ratio test (SPRT) and explain how it differs from the Neyman – Pearson testing procedure. (5 marks)

b) Construct a sequential test for testing $H_0 : \theta = \frac{1}{3}$ against $H_1 : \theta = \frac{1}{2}$, for frequency function

$$f(x,\theta) = \begin{cases} \frac{1}{\theta} e^{-\frac{1}{\theta}x} & ; \quad x \geq 0 \\ 0 & ; \quad o.w \end{cases}$$

Using $\alpha = 1\%$ and $\beta = 2\%$,

　　i.　construct a sequential test (6 marks)

　　ii.　What is the approximate number of samples that will allow the decision to accept H_1. (5 marks)

　　iii.　Obtain the operating characteristic function. (5 marks)

c) A buyer of electronic components has a lot tolerance proportion defective of 20 parts in 5,000, with a consumer's risk of 15 percent. If the buyer will sample 1,500 of the components received in each shipment,

　　i.　What acceptance number, c, would the buyer want? (5 marks)

　　ii.　What is the producer's risk if the Acceptable Quality Level (AQL) is 10 parts per 5,000? (4 marks)

QUESTION TWO (20 MARKS)

a. Choosing $\alpha = 1\%$ and $\beta = 2\%$, construct a sequential test for testing $H_0 : \sigma = 6$ against $H_1 : \sigma = 9$ for a normal variate with mean zero. What is the approximate number of samples that will allow the decision to accept H_0 (7 marks)

b. For $n = 200, c = 4, AQL = 0.5\%, and LTPD = 4\%$, find producer's risk (α) and consumer's risk (β). (7 marks)

c. A county Referral hospital admits cancer patients. The probability that a patient dies two weeks after admission to the hospital is 0.02. A sample of size n = 10 is selected and we want to test

　　　　H_0: No death occurs after two weeks of admission verses

　　　　H_1: Death occurs after two weeks of admission

Determine the Operating Characteristic (OC) for this test and interpret your results. (6 marks)

QUESTION THREE (20 MARKS)

a) Differentiate between single and double sampling acceptance plan. (2 marks)

b) Suppose that XYZ Company Limited is using rectified inspection for its single-sampling plan. Calculate the average outgoing quality limit for a plan with $n = 110$, $c = 3$, and $N = 1000$. Estimate the probabilities of acceptance for values of the proportion defective from 0.01 to 0.08 in steps of 0.01, hence plot the operating characteristic. (9 marks)

c) Consider a certain raw material for which a single-sampling attribute plan is needed. The AQL is 1 percent, and the LTPD is 4 percent. Two plans have been proposed. Under plan 1, $n = 150, and c = 4$; under plan 2, $n = 300, and c = 8$. Are the two plans equivalent? Substantiate your response by determining the producer's risk and the consumer's risk for each plan. (9 marks)

QUESTION FOUR (20 MARKS)

a) Differentiate between producer and consumer risk as used in acceptance sampling. (2 marks)

b) XYZ software purchased flash discs from ABC Company. The flash discs are packaged in batches of 1000 each. Mr. Kim, the president of XYZ Company has agreed to accept batches with 10% or fewer defective discs. Mr. Kim has directed his inspection department to select a random sample of 20 discs and examine them carefully. He will accept the batch if it has 3 or fewer defectives in the sample.

     i.   What is the probability of accepting a batch that is 10% defective? (4 marks)

     ii.   Construct an operating characteristic curve for this inspection plan. Interpret it. (7 marks)

c) Design a sampling plan for Acceptable Quality Level, $AQL = 0.1\%$, the Tolerance Proportion Defective, Tolerance proportion defective $LTPD = 0.5\%$, producer's risk $\alpha \leq 5\%$, and consumer's risk $\beta \leq 10\%$. As AQL decreases by a factor of K, what is the effect on the sample size, n?

(7 marks)

QUESTION FIVE (20 MARKS)

a) Why would you consider double sample plan than single sample plan?` (3 marks)

b) The following information is considered in designing a double sampling plan: $p_1 = 0.02$, $p_2 = 0.05$, $\beta = 0.10$, $n_1 = n_2$. Find the:

     i.   Desired sampling plan? (6 marks)

     ii.   Average sample number (ASN) curve for a double sampling plan. (5 marks)

c) For $AQL = 1\%$ and $c = 2$, what is the largest value of n that will result in a producer's risk of 5 percent? Using that sample size, determine the consumer's risk hen $LTPD = 2\%$. (6 marks)