



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

2ND YEAR 2ND SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE
(MATHEMATICS & ECONOMICS)

AMS 202 – PROBABILITY AND STATISTICS II

DURATION: 2 HOURS

DATE: 18/4/2019

TIME: 2.00 – 4.00 PM

Instructions to candidates:

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Define the following terms

- i. Random variable 2marks
- ii. Hypothesis 2marks

b) The actual content of cool drink in a 500 mm bottle is known to vary. The standard deviation is known to be 5mm. Thirty of these 500mm bottles were selected at random and their mean content found to be 498.5. Calculate the 95% and 99% confidence intervals for the population mean content of these bottles. (6marks)

c) Consider the following

X	1	2	3	4	5
F(x)	0.2	0.32	0.67	0.9	1

- i. Obtain the pdf of X 3marks
- ii. Obtain the m.g.f of X 4marks
- iii. Using the m.g.f obtained above, obtain $E(x)$ and $\text{var}(x)$ 4marks

d) The number of bacteria colonies in a petri dish is 2.5 per cm^2 . Find the probability that in 2cm^2 , there are more than 2 bacteria colonies 4marks

e) The processing speed for intel core i7 processors for a certain task is known to be normally distributed with mean 20 seconds and variance 4 seconds. A processor is picked at random, what is the probability that it will take between 10 and 13 seconds to perform the task 5marks

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- a) What is the probability that a given task will take more than 4 hours to complete if it has a gamma distribution with parameters $\alpha=2$ and $\beta = 3$? 4marks
- b) Discuss any 2 special cases of a gamma distribution 6marks
- c) The score of 1500 students in a KNEC exam are normally distributed with mean of 60 and standard deviation of 20marks.
- i) If the passmark is 40, estimate the number of candidates who will pass the exam. 3marks
- ii) Calculate the median mark. 3marks
- iii) If 20% of the students fail by obtaining/scoring m marks estimate the value of m . 2marks
- iv) What is the probability that a score picked at random differs from the actual mean by not more than 10 marks. 2marks

QUESTION THREE (20 MARKS)

- a) Let X be a geometric random variable with parameter p . The pmf of X is given by:

$$f(x) = \begin{cases} q^{x-1}p, & x = 1, 2, 3, \dots \\ 0, & \text{elsewhere} \end{cases}$$

- i. Obtain the m.g.f of X 8marks
- ii. Using the m.g.f, obtain the mean and variance of X 6marks
- b) A class has 20 girls and 30 boys. 5 students are selected at random to attend a workshop in Mombasa. Calculate the probability of.
- i) Two girls attending the workshop 3marks
- ii) At least 3 girls attending the workshop 3marks

QUESTION FOUR (20 MARKS)

a) In a certain maternity ward, the probability of giving birth to twins is 0.04. In a given night 10 women visit the ward. Calculate

- i. The probability that 5 to 7 women will give birth to twins 4marks
- ii. The probability that none of the women will give birth to twins 4marks

b) A man wants to get a daughter before he could stop bearing children. The probability of bearing a girl is 0.06. Find the probability that:

- i. The fourth born is a girl. 3marks
- ii. At least 2 attempts are needed to get girl. 3marks
- iii. He is successful in getting a girl in 3 or fewer attempts. 3marks
- iv. He needs more than 2 attempts to get a girl. 3marks