MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR SECOND SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES
BACHELOR OF SCIENCE APPLIED STATISTICS WITH COMPUTING

COURSE CODE: STA 1207-1
COURSE TITLE: PROBABILITY AND STATISTICS II

DATE: 13/5/2024 **TIME: 0830-1030 HRS**

INSTRUCTIONS TO CANDIDATES

1. Answer **Question ONE** and any other **Two** questions.
2. Show all the workings clearly
3. Do not write on the question paper
4. All Examination Rules Apply.

Question One (20 Marks)

(a) The p.d.f of a random variable X is given by

$$f(x)=\begin{cases} k\left(\frac{2}{3}\right)^{x}, & x=0,\,1,\,2,\ldots \\ 0 & \textit{elsewhere} \end{cases}$$

Find

(i) the value of the constant k **(3 Marks)**

(ii) $P(X>2)$ **(3 Marks)**

(b) A random variable X has p.d.f given by

$$f(x)=\begin{cases} 2(1-x), & 0<x<1 \\ 0, & \textit{elsewhere} \end{cases}$$

Find

(i) the mean and variance of X **(4 Marks)**

(ii) $P(\frac{1}{2}<X<1)$ **(2 Marks)**

(c) The m.g.f of random variable X is given by $m(t)=\left(\frac{3}{5}+\frac{2}{5}e^{t}\right)^{6}$

(i) What is the p.d.f of X? **(2 Marks)**

(ii) Find the probability that the observed value of X is an even number. **(2 Marks)**

(d) If $X\sim N(6,25)$ find

(i) $P(5<X<10)$ **(2 Marks)**

(ii) $P(X>8)$ **(2 Marks)**

Question Two (15 Marks)

(a) Let $f(x)=\begin{cases}2x, & 0<x<1\\ 0, & elsewhere\end{cases}$ be the p.d.f of random variable X. Find

i. the c.d.f of X **(3 Marks)**

ii. μ_3, the third central moment of X about the mean **(5 Marks)**

(b) The p.d.f of a random variable X is given by

$f(x)=\begin{cases}e^{-(x+3)}, & -3<x<\infty\\ 0, & elsewhere\end{cases}$. Find

(i) the m.g.f of x **(4 Marks)**

(ii) $P(X>1)$ **(3 Marks)**

Question Three (15 Marks)

(a) A coin is biased so that it is twice as likely to show tails as heads. Find the probability that in six tosses of the coin

(i) exactly two heads are obtained **(4 Marks)**

(ii) less than three heads are obtained **(4 Marks)**

(b) If the number of bacterial colonies on a petri dish follows a poisson distribution with average number 1.5 per cm^2, find the probability that

(i) in $2cm^2$ there will be no bacterial colonies **(3 Marks)**

(ii) in $1.5cm^2$ there will be less than 3 bacterial colonies **(4 Marks)**

Question Four (15 Marks)

(a) The random variable X has p.d.f given by $f(x)=\frac{1}{5\sqrt{2\pi}}e^{-\frac{1}{50}(x^2-20x+100)}$, $-\infty<x<\infty$.

Find

(i) $P(X < 5)$ **(4 Marks)**

(ii) $P(7.5 < X > 12.5)$ **(4 Marks)**

(a) In a lot of 40 light bulbs, there are 5 bad bulbs. An inspector inspects 8 bulbs selected at random. Find the probability of finding

(i) two defective bulbs **(3 Marks)**

(ii) at most two defective bulbs **(4 Marks)**

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