MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY

EXAMINATION

2023/2024 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SCHOOL OF SCIENCE AND INFORMATION SCIENCES

BACHALOR OF SCIENCE IN APPLIED STATISTICS

COURSE CODE: STA 2217-1

COURSE TITLE: MATHEMATICAL STATISTICS II

DATE: TIME:

INSTRUCTIONS TO CANDIDATES

i. Question **ONE** is compulsory
ii. Answer any other **TWO** question

QUESTION ONE 20 MARKS

(a) Giving relevant example, explain the term Random Variable (3mks)

(b) A manufacturing company inspects a batch of transistors occasionally and notices that 90% has no defective one, 5% contain one defective, 3% likely contain 2 and about 2% contain 3 defectives transistors.

i) Define distribution of a random variable (lmk)

ii) Develop a probability distribution table (3mks)

iii) Work out the mean and standard deviation of transistors being defectives

(5mks)

(c) Differentiate between discrete and continuous random variable (2mks)

(d) Define probability distribution function of a discrete random variable (3mks)

(e) The continuous random variable I has *pd f f(x)* where $f(x) = \{\frac{1}{8}x$

$0 < x > 4$

Show that it is a valid pdf and hence find E (x) and Var (x). (3marks)

QUESTION TWO 15 MARKS

a) Let x be a continuous random variable with pdf

$$f(x)\begin{cases} ax & 0 \le x \le 1 \\ a & 1 \le x \le 2 \\ -ax + 3a & 2 \le x \le 3 \end{cases}$$

I. Determine the constant a (3marks)

II. Compute probability of p (≤ 1.5) (3marks)

b) A fair die is tossed once. Let x, be the number on the upturned face. Compute the cumulative function of x. (7marks)

QUESTION THREE 15 MARKS

a) Show that $\mu_4 = \mu_4 - 4\mu_3\mu_1 + 6\mu_2(\mu_1)^2 - 3(\mu_1)^4$ (5 marks)

b) Let x be a continuous random variable with pdf f(x) given by

$$f(x) = \begin{cases} \lambda e^{-\lambda x}, & x > 0 \\ 0, & x > 0 \end{cases}$$

Elsewhere;

I. Find its M.G.F if it exists (3marks)

II. Derive the expected value of x and the variance of x from the m.g.f (3marks)

III. Verify the results by computing the above quantities directly from the deviation. (3marks)

QUESTION FOUR 15 MARKS

(a) Let x ≥ 0 be a random variable and let t > 0.

Prove the Markov In-equality $P\ (X \geq t) \leq \frac{E(x)}{t}$ (4mks)

$\boldsymbol{t}$

(b) A post office handles, on average, 10,000 letters a day. What can be said about the probability that it will handle at least 15000 letters tomorrow? (use Markov in-equality) (3mks)

(c) If μ and σ are the mean and standard deviation of a random variable X, show that for any positive constant *k*, the probability is at least $\left(1-\frac{1}{K^2}\right)$that X will take on a value within *k* standard deviation of the mean. i.e. $P([X-\mu] < r\sigma) \geq 1-\frac{1}{k^2}$ (8mks)