

The
Management
University
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UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF EDUCATION (SOE)

DEGREE OF BACHELOR OF EDUCATION ARTS

MTH 232: PROBABILITY & STATISTICS II

DATE: 3RD AUGUST 2026

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

- a) Find the distribution function of the total number of heads obtained in four tosses of a balanced coin

**(5
marks)**

- b) Given the joint probability density function

$$f(x,y) = \begin{cases} \frac{3}{5} x(y+x) & \text{for } 0 < x < 1, \quad 0 < y < 2 \\ 0 & \text{elsewhere} \end{cases} \quad \text{of two}$$

random variables x and y , find $P[(X,Y) \in A]$, where A is the region

$$\{(x,y) \mid 0 < x < \frac{1}{2}, \quad 1 < y < 2\}$$

(4

marks)

- c) If X is the number of points rolled with a balanced die, find the expected value of $g(X) = 2X^2 + 1$

**(5
marks)**

- d) Consider an experiment of tossing two dice. Let X_1 and X_2 denote the outcome of the first die and second die respectively. If Y is the absolute difference of $X_1 - X_2$, that is $Y = |X_1 - X_2|$, find the variance of Y

(6

marks)

- e) An institution X messenger is asked to deliver 10 out of 16 letters to the Institute of computer science department and the remaining to Education department. He gets the letters mixed up and on arrival in the computer science department delivers 10 letters at random to the department.

What is the probability that only six of the letters to be delivered to the computer science department actually arrive there?

(5 marks)

QUESTION TWO

a) Given the probability mass function (pmf) of X as;

$$f(x) = \begin{cases} \frac{x+1}{15} & , [0, 1, 2, 3, 4] \\ 0 & elsewhere \end{cases}$$

find the pmf of $y = (x-2)^2$ **(5**

marks)

b) Determine if the function given by $f(x) = \frac{x+2}{25}$ for $x = 1, 2, 3, 4, 5$ can serve as the probability distribution function of a discrete random variable **(3 marks)**

c) The probability density function (pdf) of the random variable X is given by

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

i) find the constant C **(3 marks)**

ii) determine the cumulative density function(cdf), F(x) **(4 marks)**

QUESTION THREE

a) X is a continuous random variable such that Find the constant C such that the function

$$f(x) = \begin{cases} \frac{x}{2} & , 0 \leq x < 1 \\ \frac{2}{3} - \frac{x}{6} & , 1 \leq x \leq 4 \\ 0 & elsewhere \end{cases}$$

i) Find E(X) **(4 marks)**

- ii) Find $E(X^2)$
(4 marks)

- b) If 2% of the fuses delivered to a company are defective, using Poisson approximately, what is the probability that a random sample of 400 of these fuses will contain exactly 6 defective fuses?

(7 marks)

QUESTION FOUR

- i) Find the probability of getting five heads and seven tails in 12 flips of a balanced coin. (4 marks)

- ii) If the probability is 0.75 that an applicant for a drivers license will pass the road test on any given try, what is the probability that an applicant will finally pass the test on the fourth try.

(3 marks)

- a) If the joint probability density of X and Y is given by

$$f(x,y) = \begin{cases} x+y & \text{for } 0 < x < 1, 0 < y < 1 \\ 0 & \text{elsewhere} \end{cases}$$

find the joint distribution function of these two random variables

(8 marks)

QUESTION FIVE

- a) Let X has the following probability density function (pdf)

$$f(x) = \begin{cases} 6x(1-x) & \text{for } 0 < x < 1 \\ 0 & \text{elsewhere} \end{cases}$$

find the pdf of $Y = x^3$

(5 marks)

- b) Let Y be a continuous variable. Show that the function

$$f(y) = \begin{cases} \frac{y}{2} & 0 \leq y \leq 2 \\ 0 & \text{elsewhere} \end{cases}$$

is a probability density function (pdf) and hence find $P\left(\frac{1}{2} \leq y \leq 1\right)$ and $P(-1 \leq y \leq 1)$ **(5 marks)**

c) Let X be a discrete random variable with the following

$$\text{probability function (pdf), } f(x) = \begin{cases} 0.3 & \text{for } x < 3 \\ 0.2 & \text{for } 3 \leq x < 5 \\ 0.3 & \text{for } 5 \leq x < 8 \\ 0.2 & \text{for } 8 \leq x < 10 \\ 0 & \text{elsewhere} \end{cases}$$

Find the cumulative density function (cdf) **(5 marks)**

QUESTION SIX

a) The continuous variable X has probability density function (pdf)

$$f(x) = \begin{cases} k(x-2) & 2 \leq x < 3 \\ k & 3 \leq x < 5 \\ k(6-x) & 5 \leq x < 6 \\ 0 & \text{elsewhere} \end{cases}$$

i) Sketch the graph of $f(x)$ **(3 marks)**

ii) Show that the value of k is $\frac{1}{3}$ **(2 marks)**

- b) Let X be a discrete random variable with probability mass function (pmf)

$$f(x) = \begin{cases} \frac{1}{20}(x+1) & x=1, 2, 3, 4, 5 \\ 0 & \text{elsewhere} \end{cases}$$

- i) Sketch the graph of $f(x)$ **(4 marks)**
- ii) Determine the cumulative density function (cdf) **(4 marks)**
- iii) sketch its graph **(2 marks)**