THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

SECOND SEMESTER EXAMINATION – 2023

SECOND YEAR BACHELOR OF PROPERTY PROFESSIONAL STUDIES

MA226 – QUANTITATIVE METHODS 2 (BPST2)

TIME ALLOWED: 3 HOURS

INSTRUCTIONS FOR CANDIDATES

1. Write your name and student number clearly on the front of the examination answer booklet.
2. You have **10 minutes** to read this paper. You must **not** begin writing during this time.
3. This paper contains **five** (5) questions. You are to answer **all** the questions.
4. All answers must be written on the **examination answer booklet(s)** provided. No other written materials will be accepted.
5. Start the answer for each question on a **new** page. Do **not** use red ink.
6. Notes, textbooks, mobile phones and other devices are not allowed in the examination room.
7. Scientific and business calculators are allowed in the examination room.
8. A **formula sheet** is attached to this examination paper.

MARKING SCHEME

Marks are as indicated at the beginning of each question. Total mark is **100**.

Question 1 [(6 + 2 + 2) + (2 + 4 + 4)] = 20 marks]

(a) A and B are ***mutually exclusive*** events such that P(A) = 2/5, P(B) = 3/10.

	B	B^c	
A			2/5
A^c			
	3/10		1.00

Use this information to:

(i) copy and complete the table above and express answers in simplified fraction form.
(ii) find $P(A/B^c)$.
(iii) find $P(A^c/B^c)$.

(b) A bag contains 3 red, 2 blue, and 1 white marbles. A marble is selected at random from the bag and not replaced before the second marble is selected. Find the probability that:

(i) both marbles drawn being red.

(ii) at least one marble drawn is white.

(iii) both marbles drawn are of same colour.

Question 2 [2 + 3 + 3 + 3 + 3 + 3 + 3 = 20 marks]

Below are results of 13 students who sat for a test out of 30 marks.

28 20 25 23 27 21 29 19 26 22 24 30 18

From the data set above, and express your answers to 2 decimal places where applicable, find the:

(a) median.
(b) mean.
(c) interquartile range.
(d) variance.
(e) standard deviation.
(f) **z-score** of the student who scored a **28** in this test.
(g) **t-score** of the student who scored a **20** in this test.

Question 3 [10 + 2 + 2 + 2 + 2 + 2 = 20 marks]

The table below shows the number of children per household in West Taraka Suburb.

Number of children per household (x)	0	1	2	3	4
Probability (%)	1%	3%	50%	30%	16%
$xP(x)$					
$(x-\mu)^2P(x)$					

(a) Copy and complete the table for $xP(x)$ and $(x-\mu)^2P(x)$ rows.
(b) Calculate the expected value (μ) of the number of children per household.
(c) Calculate the variance (σ^2) of the number of children per household to 5 decimal places.
(d) Calculate the standard deviation (σ) of the number of children per household to 5 decimal places.
(e) What is the probability of having at the most 1 child per household? Is that usual?
(f) What is the probability of having at the least 3 children per household? Is that usual?

Question 4 [(2 + 4 + 2 + 2) + (2 + 2 + 3 + 3) = 20 marks]

(a) Globally approximately 10% of all people are left-handed. Five (5) people were involved in this experiment.

(i) Argue that it is a binomial experiment.

(ii) Calculate $P(x \leq 1)$ to 5 decimal places.

(iii) Calculate the mean for this experiment.

(iv) Calculate the standard deviation for this experiment to 5 decimal places.

(b) The average number of accidents at a level-crossing every year is 5 and has a Poisson distribution. Calculate the probability, to 5 decimal places, that there are:

(i) no accidents.

(ii) exactly 2 accidents.

(iii) at the most 2 accidents.

(iv) at the least 3 accidents.

Question 5 [5 + 5 + 5 + 5 = 20 marks]

Suppose a random variable (x) is continuous over the interval $[0, 0.6]$. Find $P(0.1 \leq x \leq 0.5)$ for each of the probability functions $f(x)$ given below.

(a) $f(x) = 2$

(b) $f(x) = 2x$

(c) $f(x) = 3x^2$

(d) $f(x) = \frac{1}{2}$

..... **End of Examination**.....

MA226 SEMESTER 2 EXAMINATION FORMULA SHEET 2023

Conditional Probability Tables

	B	Bc	
A	P(A∩B)	P(A∩B^c)	P(A)
Ac	P(A^c∩B)	P(A^c∩B^c)	P(A)^c
	P(B)	P(B)^c	1.00

$P(A/B) = \frac{P(A \cap B)}{P(B)}$	$P(B/A) = \frac{P(B \cap A)}{P(A)}$
$P(A^c/B) = \frac{P(A^c \cap B)}{P(B)}$	$P(B^c/A) = \frac{P(B^c \cap A)}{P(A)}$
$P(A/B^c) = \frac{P(A \cap B^c)}{P(B^c)}$	$(B/A^c) = \frac{P(B \cap A^c)}{P(A^c)}$
$P(A^c/B^c) = \frac{P(A^c \cap B^c)}{P(B^c)}$	$P(B^c/A^c) = \frac{P(B^c \cap A^c)}{P(A^c)}$

Laws of Probability

P(A ∪ B) = P(A) + P(B) – P(A ∩ B) . If event A and B are mutually exclusive, then P(A ∩ B) = 0

Descriptive Statistics & Normal Distribution

	Formula
Average	$\mu = \frac{\sum fx}{\sum f}$
Variance	$\sigma^2 = \frac{\sum (x-\mu)^2}{\sum f}$
Standard deviation	$\sigma = \sqrt{\frac{(x-\mu)^2}{\sum f}}$

	Formula
z - score	$z - score = \frac{x-\mu}{\sigma}$
t - score	$t - score = 10z + 50$
skewness	$Sk = \frac{3(\mu - median)}{\sigma}$

Binomial Theorem: $(a+b)^n = \sum_0^n \binom{n}{r} a^{n-r} b^r$ where $0 \leq r \leq n$

Binomial Distribution: $\boldsymbol{P(x=r) = \binom{n}{r} p^r q^{n-r}}$ where $0 \leq r \leq n$

Poisson Distribution: $\boldsymbol{P(x=r) = \frac{e^{-\lambda}.\lambda^x}{x!}}$ for $r = 0, 1, 2, 3, \ldots.$

Type equation here.	Discrete Random Variable	Binomial Experiment
Mean (μ)	$\sum xP(x)$	np
Variance (σ^2)	$\sum (x-\mu)^2 P(x)$	npq
Standard Deviation (σ)	$\sqrt{\sum (x-\mu)^2 P(x)}$	$\sqrt{npq}$

In Poisson Distribution: Mean (λ) = Variance (σ^2) = Standard Deviation (σ) = np