UGANDA MARTYRS UNIVERSITY
NKOZI

UNIVERSITY EXAMINATIONS
DECEMBER 2022

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCES

END OF SEMESTER ONE FINAL ASSESSMENT

SECOND YEAR EXAMINATION

BSC.GENERAL (II) & Bsc. EDU (II)

PROBABILITY THEORY

DATE: Friday, 16th/12/2022
DURATION: 3HRS (2:00- 5:00 PM)

Instructions:

1. *Carefully read through ALL the questions before attempting*
2. ***ANSWER FOUR (4) Questions****ONLY. (Each question carries equal marks)*
3. *No **names** should be written anywhere on the examination book.*
4. *Ensure that your **ID number** is indicated on all pages of the examination answer booklet.*
5. *Ensure your work is **clear** and **readable**. Untidy work shall be penalized*
6. *Any type of examination Malpractice will lead to automatic disqualification*
7. *Do not write anything on the questions paper.*

QUESTION 1

A and B are mutually exclusive events such that, Pr (AUB) = 0.8 and Pr (AnB^1) = 0.5

Find the (i) Pr (AnB) (ii) Pr (B) (iii) Pr (A^1nB^1) (iv) Pr (A^1UB) **[03 marks @]**

(b) Given two events A and B, explain what is meant by the following terms

(i) A and B are independent events

(ii) A and B are mutually exclusive events **[02 Marks@]**

© A loaded die with even numbers twice as likely to occur as odd numbers is tossed.

What is the probability of?

(i) Getting a 5? **[04 marks]**

(ii) Getting a 5 given that the number greater than 3 has occurred? **[05 marks]**

QUESTION 2

A discrete random variable has a probability distribution

X	1	2	3	4
Pr (X= x)	1/2	k	1/8	1/8

Find. (i) k (ii) E(X) (iii) Var (X) (iv) E (6X +2) (v) Var (3X -9) **[03 marks @]**

(b) A discrete random variable has a probability distribution

P(X=x) = a/X for x =1, 2, 3, 4 and 0 otherwise

Determine (i) value of a **[02 marks]**

(ii) Pr ($X \leq$ a) **[02 marks]**

(iii) E(X) **[02 marks]**

(iv) The variance and standard deviation of X **[04 marks]**

QUESTION 3

(a) (i) Define decision tree **[1 marks]**

(ii) State the uses of decision tree **[4 marks]**

(b) Should we develop a new product or consolidate and why? **[10 marks]**

Stage I	Stage II	Stage III
New product	Through development (cost = $150,000)	Good (pr = 0.4, $ 1,000,000)
		Moderate (pr= 0.4, $ 50,000)
		Poor (pr = 0.2,$2000)
	Rapid development (cost= $80,000)	Good (p = 0.1,$1,000,000)
		Moderate (pr = 0.2,$50,000)
		Poor (pr = 0.7, $ 2000)
Consolidate	Strengthen the product (cost = $30,000)	Good (pr = 0.3, $ 400,000)
		Moderate (pr= 0.4, $ 20,000)
		Poor (pr = 0.3,$6000)
	Reap products (cost = $0)	Good (pr = 0.6, $ 20,000)
		Poor (pr = 0.4,$2000)

© The NIC insurance company insures 100,000 cars. Their records indicate that during a year they will pay out the following for accidents;

X in $ (Dollars)	100,000	50,000	25,000	5,000	1,000
Pr(X= x)	0.0001	0.001	0.002	0.008	0.02

What amount of money would the company expect to pay per car for accidents?

[10 marks]

QUESTION 4

a) Briefly define the following

i. Sample space**[2 marks]**

ii. Independent Events**[2 marks]**

iii. Mutually exclusive**[2 marks]**

iv. Conditional probability**[2 marks]**

b) State De Morgan's laws of probability**[2 marks]**

c) A and B are events associated with an experiment such that P(B)=1/6, P(B/A)=1/3,

P(An B)=1/12. Find:

i. P(A) **[3 marks]**

ii. P(A/B) **[3 marks]**

iii. P(A/B') **[5 marks]**

iv. State whether events A and B are independent or mutually exclusive **[4 marks]**

QUESTION 5

a) Define the terms:

i. Random Variables **[2 marks]**

ii. Continuous random variable **[3 marks]**

b) A box contains 9 blue balls and 5 green balls. 2 balls are picked from the box one after the other. Find the probability of picking one blue and one green in any order given:

i. The first ball is not replaced **[4 marks]**

ii. The first ball is replaced **[4 marks]**

c) A continuous random variable has probability density function as

$F(x) = \{kx^3 \quad 0 \leq x \leq 4$

$0 \quad$ Elsewhere

i. Find the value o f k **[4 marks]**

ii. Calculate the E(X) and Var(X) **[8 marks]**

QUESTION 6

(a) (i) Define probability of an event **[2maks]**

(ii) Three men **P, Q** and **R** pack biscuits in a factory. From the batch allocated to them, **P** packs 55%, **Q** (30%) and **R** (15%). The probability that **P** breaks some biscuits in a packet is 0.7 and the respective probabilities for **Q** and **R**, are 0.2 and 0.1 respectively. What is the probability that a packet with broken biscuits found by the checker was packed by **P**? **[6marks]**

(b) A business firm from Masaka District saved money for investment. The management wanted to start two projects (I & II). Below are expected sales from the projects.

PROJECT I		PROJECT II	
SALES ($)	Probability	SALES ($)	Probability
8,000	0.25	10,000	0.15
8,500	0.60	9,000	0.60
9,500	0.15	5,500	0.25

The firm's profit is 85% of the sales.

(i) Calculate the expected profit under each project. **[4 marks]**

(ii)Which project would you recommend to the management for the better returns? **[2 Marks]**

(iii) Calculate the standard deviation of the distribution of the profits for each project.**[4 Marks]**

(iv)What is the coefficient of variation for each project? **[4 Marks]**

(v)As a risk expert, which project would you recommend to the management?**[3 marks]**

END