(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: STA 142

COURSE TITLE: INTRODUCTION TO PROBABILITY

DATE: 18/10/18 **TIME:** 8 AM -10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE(30 Marks)

a) Differentiate between the following terms as used in probability and set theory

(i) Intersection and union of sets (2Marks)

(ii) Mutually exclusive events and independent events (2Marks)

(iii) Discrete and continuous random variables (2Marks)

b) Prove the following

(i) The probability of an impossible event is zero , that is $P(\phi) = 0$ (2Marks)

(ii) If A^c is the compliment of A then $P(A^c) = 1 - P(A)$ (3Marks)

c) The events A and B are independent and are such that $P(A) = x,\ P(B) = x + 0.2$

and $P(A \cap B) = 0.15$ .Find the value of x hence or otherwise find the value of

$P(A \cup B)$. (5Marks)

d) The letters of the word **MATHEMATICS** are written one on each of 11 separate cards. The cards are laid out in a line

(a) Calculate the number of different arrangements of the letters (2Marks)

(b) Compute the probability that the vowels are all placed together (3Marks)

e) A discrete random variable x has probability distribution function given by

$$f(x) = \begin{cases} (\frac{1}{2})^x, x = 1,2,3,4,5 \\ C, x = 6 \\ o, elsewhwere \end{cases}$$

(i)Construct a probability distribution hence determine C (3Maks)

Compute

$E(X)$ (3Marks)

$Var(X)$ (3Marks)

QUESTION TWO (20MARKS)

(a) Prove the following:

(i) The probability of an Impossible set is zero that is $P(\phi) = 0$ (2 mks.)

(ii) P(A∪B) = P(A) + P(B) – (P∩B) (4 mks.)

(b) Distinguish between the following terms as used in probability theory:

(i) Union and Compliment of a set (2 mks.)

(ii) Probability mass function and probability density function. (2 mks.)

(c) Permutation and Combination (4mks)

(d) Prove that if $B_1,\ B_2 \ldots\ldots\ldots B_n$ are exhaustive and mutually exclusive random experiments and A be

an event related to B_i then

$$P(B_i / A) = \frac{P(B_i)P(A/B_i)}{\sum_{i=1}^{n} P(B_i)P(A/B_i)}$$ (6mrks)

QUESTION THREE

(a)A Discrete random variable X has the following p d f

$$P(X = x) = \begin{cases} k(2-x), x = 0,1,2 \\ k(x-2), x = 3 \\ 0 elsewhere \end{cases}$$

Where k is a positive constant

(i) Find the value of k (4mks)

(ii)Compute E(X) AND Var(X) (5mks)

b)A continuous random variable X has pdf f(x) given by

$$f(x) = \begin{cases} k(x^3 + x),\ 0 < x < 2 \\ 0,\ elsewhere \end{cases}$$

i) Determine the value of k (4mks)

ii) Find the expected value and variance of X (7mks)

Question Four (20 Marks)

a) The probability that Anne goes to the show is $\frac{1}{3}$. If she goes to the show the probability that she sees a python is $\frac{2}{5}$ and if she doesn't go to the show the probability that she sees a python is $\frac{1}{8}$. Find the probability that
   i) Anne goes to the show but doesn't see a python. (2mks)
   ii) Anne sees a python elsewhere. (2mks)

b) A team of four is chosen at random from five ladies and six men. In how many ways can the team be chosen if
   i) There are no restrictions (2mks)
   ii) There must be more girls than boys (6mks)
   iii) Find the probability that the team contains only one man (4mks

(c)Distinguish between:
   i) A set and a subset (2mks)
   ii) Equal sets and equivalent sets (2mks)

Question Five (30 Marks)

a) Define statistical probability (2Marks)

b) Explain the axioms of probability

c) Given that $P(A)^c = 0.47$, $P(B) = 0.72$ and $P(AnB) = 0.48$, compute
   i) P(A) (3mk)
   ii) $P(B)^c$ (3mk)
   iii) $P(\overline{AUB})$ (3mks)

d) In a class of 60 boys there are 45 who play football and 30 who play tennis.
   i) Using a Venn diagram show how many boys play both games? (3mks)
   ii) How many play football only? (3mks)
   iii) How many play tennis only? (3mrks)