



## GARISSA UNIVERSITY

### UNIVERSITY EXAMINATION **2017/2018** ACADEMIC YEAR **TWO** **FIRST** SEMESTER EXAMINATION

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

FOR THE DEGREE OF MASTERS OF SCIENCE IN COMPUTER  
SCIENCE

COURSE CODE: STA 205

COURSE TITLE: PROBABILITY AND STATISTICS

EXAMINATION DURATION: 3 HOURS

**DATE: 18/04/18**

**TIME: 09.00-12.00 PM**

---

#### INSTRUCTION TO CANDIDATES

- The examination has SIX (6) questions
- Question ONE (1) is COMPULSORY
- Choose any other THREE (3) questions from the remaining FIVE (5) questions
- Use sketch diagrams to illustrate your answer whenever necessary
- Do not carry mobile phones or any other written materials in examination room
- Do not write on this paper

This paper consists of FOUR (4) printed pages

*please turn over*



**QUESTION ONE (COMPULSORY)**

- (a) Define the following terms
- Statistical experiment
  - Sample space
  - Simple random sample
  - Population distribution
- [4 marks]**
- (b) A discrete random variable has probability distribution given by  $f(x) = \begin{cases} \frac{x}{6} & x = 1, 2, 3 \\ 0 & \text{otherwise} \end{cases}$ . Find  $E(X)$  **[3 marks]**
- (c) A fair coin is tossed twice. Tabulate the probability distribution of the number of heads obtained **[2 marks]**
- (d) A random variable  $X$  can only take the values 2 and 5. Given that the value 5 is twice as likely as the value 2, determine the  $E(X)$ . **[4 marks]**
- (e) Between 6 pm and 7 pm, Directory Enquiries receives calls at the rate of 2 per minute. Assuming that the calls arrive at random points in time, determine the probability that 4 calls arrive in a randomly chosen minute. **[2 marks]**
- (f) A gambler has a biased coin for which the probability of a head is 0.55. He tosses the coin 8 times. What is the probability of him getting 6 heads? **[3 marks]**
- (g) Find the covariance for the given data **[3 marks]**

Height (m) $x$	1.60	1.64	1.71
Mass (kg) $y$	53	57	60

- (h) The data below show marks in a mathematics and physics examination. Calculate the Pearson's coefficient of correlation from the data. **(4 marks)**

Mathematics: $x$	48	35	17	23	47
Physics: $y$	45	20	40	25	45

**QUESTION TWO**

- (a) The price of an "HP" computer decreases at a rate shown in the table below.

Age (yrs)	1	2	3	4	5	6	7	8	9	10
Price(x sh 100)	108.4	102.2	95.5	87.2	81.1	75.4	70.2	65.0	58.7	52.5

- Compute the product moment correlation coefficient **[5 marks]**
  - Find the least squares regression line of the price ( $y$ ) on age ( $x$ ) for the data and use it to find the most likely price for a computer of  $8\frac{1}{2}$  years **[5 marks]**
- (b) Every day, the number of network blackout has a probability distribution given by

$X$	0	1	2
$P(X = x)$	0.7	0.2	0.1

A small internet company estimates that each network blackout results in a loss of ksh 500. Compute the expected and the variance of this company's daily loss due to blackouts

**[5 marks]**



### QUESTION THREE

- (a) Two discs are drawn, without replacement, from a box containing 3 red discs and 4 white discs. The discs are drawn at random. If  $X$  is the random variable “number of red discs drawn”, find
- The expected number of red discs [3 marks]
  - The standard deviation of  $X$  [2 marks]
- (b) A continuous random variable  $X$  has the probability density function  $f(x)$  given by  $f(x) =$
- $$\begin{cases} kx & \text{for } 0 \leq x < 2 \\ \frac{1}{2}kx(4-x) & \text{for } 2 \leq x < 4 \\ 0 & \text{otherwise} \end{cases}$$
- where  $k$  is a constant. Find the
- Value of  $k$  [3 marks]
  - $E(X)$  and  $Var(X)$  [7 marks]

### QUESTION FOUR

- (a) Two events,  $A$  and  $B$  are such that  $P(A) = 0.5$ ,  $P(B) = 0.4$  and  $P(A/B) = 0.3$ .
- State whether or not  $A$  and  $B$  are statistically independent. Give a reason [2 marks]
  - Find the value of  $P(A \cap B)$  [2 marks]
- (b) Two events  $A$  and  $B$  are such that  $P(A) = 0.7$ ,  $P(B) = 0.4$  and  $P(A/B) = 0.3$ . Determine the probability that neither  $A$  nor  $B$  occurs. [4 marks]
- (c) A statistician has a fair coin and a double headed coin. She chooses one of the coins at random and tosses it. She obtains a head. Using Baye’s theorem, determine the probability that the coin she tossed was double headed.

Define the events as follows:

- a head is obtained
- the fair coin is chosen
- the double headed coin is chosen [5 marks]

### QUESTION FIVE

- (a)  $P(A) = \frac{1}{3}$ ,  $P(B) = \frac{1}{4}$ , and  $P(A/B) = \frac{2}{5}$ . Find
- $P(B/A)$  [3 marks]
  - $P(A \cap B)$  [3 marks]
- (b) Two events  $A$  and  $B$  are such that  $P(A) = \frac{1}{4}$ ,  $P(A/B) = \frac{1}{2}$ , and  $P(B/A) = \frac{2}{3}$ . Find
- $P(A \cap B)$  [1 mark]
  - $P(B)$  [2 marks]
  - Are  $A$  and  $B$  mutually exclusive? [2 marks]
- (c) Three girls, Aileen, Barbara and Cathy, pack biscuits in a factory. From the batch allocated to them, Aileen packs 55%, Barbara 30% and Cathy 15%. The probability that Aileen breaks some biscuits in a packet is 0.7 and the respective probabilities for Barbara and Cathy are 0.2 and 0.1. What is the probability that a packet with broken biscuits found by a checker was packed by Aileen [4 marks]



### QUESTION SIX

- (a) Define the following terms
- Statistical inference
  - Point estimate
  - Unbiased estimate
- [3 marks]**
- (b) An environmentalist takes a random sample of water from a river. She discovers that her 100ml sample contains 64 organisms of a particular type. Give a 99% confidence interval for the mean number of these organisms in a liter of this river water. **[3 marks]**
- (c) Stephen takes a random sample of 20 observations from a population with unknown mean,  $\mu$ , and unknown variance,  $\sigma^2$ . His sample has a mean of 16.2 and an unbiased estimate of the population variance equal to 27.34. Independently, George takes a random sample of 16 observations from the same population. His sample has a mean of 18.0 and an unbiased estimate of the population variance equal to 35.40. Combining their results to give a single sample, obtain an appropriate 95% confidence interval for the population mean, giving the confidence limits correct to two decimal places.

Degree of confidence (%)	90	95	98	99
Percentage points	1.645	1.960	2.326	2.576

**[9 marks]**

