MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 212: PROBABILTY AND STATISTICS FOR COMPUTER SCIENCE

DATE: **TIME:**

INSTRUCTIONS TO CANDIDATES.

1. *This paper consists of **Five** questions.*
2. *Answer **Question 1** and any other **Two** questions.*
3. *You **must** have a scientific calculator for this paper.*

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Explain the meaning of the following terms as applied in probability theory giving examples.
   i. Sample space (2 marks)
   ii. Random variable (2 marks)

b) Differentiate between EACH of the following terms as applied in statistics.
   i. Descriptive and Inferential statistics. (2 marks)
   ii. Type 1 and Type 11 error. (2 marks)

c) Consider the probability distribution of a discrete variable below.

X	8	12	16	20	24
P (X=x)	1/8	1/6	m	1/4	1/12

Determine

   i. m (2 marks)
   ii. the mean of the distribution (2 marks)
   iii. P (X >12) (2 marks)

d) The data given below represents the frequency distribution of marks scored in mathematics by 250 students.

Grade scores	1	2	3	4	5	6	7	8

No. of students	8	20	36	64	48	40	24	10

Determine each of the following measures about the distribution

i. Median (2 marks)
ii. Mean (2 marks)
iii. Standard deviation (3 marks)

e) In a random sample of 16 computer stores, the mean waiting time for being served is 104 minutes with a standard deviation of 5 minutes. Construct a 95% confidence interval for the average waiting time (5 marks)

f) How many ways are there to choose.

i. A committee of 4 persons from a group of 10 persons, if order is not important? (2 marks)

ii. If all the outcomes are equal likely, find the probability that a particular person is on the committee? (2 marks)

QUESTION TWO (20 MARKS)

a) Proof the joint distribution function of independent random variables X and Y satisfies, $F_{X,Y}(x, y) = F_X(x).F_Y(y)$ (4 marks)

b) Consider two random variables X and Y with joint PMF given below.

	Y =2	Y =4	Y =5
X=1	1/12	1/24	1/24
X=2	1/6	1/12	1/8
X =3	1/4	1/8	1/12

i. Find P (X≤2, Y≤4) (4 marks)
ii. Find the marginal PMFs of X and Y (4 marks)
iii. Find P(Y=2|X=1) (4 marks)
iv. Are X and Y independent? (4 marks)

QUESTION THREE (20 MARKS)

a) Differentiate between the dependent variable and the independent variable as defined on a linear regression equation and give an example. (2 marks)

b) A TV network is concerned about the high cost of producing many of its programs. A study is conducted to relate the production costs for 30 minutes of programming (in hundreds of thousands of dollars) to the ratings that the program gets in the national ratings survey. The results are shown below:

Production cost	1.2	1.6	1.8	2.5	2.7	3.0	3.5	4.4
Ratings	3.3	3.9	5.7	4.2	4.5	8.2	6.1	4.6

i. Compute the Pearson's correlation co-efficient between ratings and the production cost. (8 marks)
ii. Interpret the correlation coefficient obtained in (i). (2 marks)
iii. Determine the least squares regression equation relating the ratings to the production costs. (6 marks)
iv. Using the regression line obtained in (iii) above estimate the ratings when the costs is 6.5 dollars? (2 marks)

QUESTION FOUR (20 MARKS)

a) Given that x is a random variable with a Probability density function defined as.

$$f_X(x) = \begin{cases} cx^2 & |x| \leq 1 \\ 0 & 0therwise \end{cases}$$

i. Find the constant c (3 marks)
ii. Find E (X) and Var(X) (6 marks)
iii. Find P(X$\geq \frac{1}{2}$) (3 marks)

b) The mean weight of 800 male students at a certain college is 140kg and the standard deviation is 10kg assuming that the weights are normally distributed find how many students.

i. weigh between 130 and 148kg (5 marks)
ii) weigh more than 152kg (3 marks)

QUESTION FIVE (20 MARKS)

a) Explain the meaning of the following terms as used in probability theory giving examples.

i. Independent events (2 marks)
ii. Mutually exclusive Event (2 marks)

b) Let X have mean $\mu = E(X)$, proof the variance of X is.

Var (X) = E$[(X - \mu)^2]$ (5 marks)

c) The mean number of deaths on any day on a national highway is a Poisson process with parameter λ=1.8 per day. Determine the probability that the number of accidents is.

i. P (X$\geq$ 1) (3 marks)
ii. P (X$\leq$ 1) (3 marks)

d) A sample of 400 items is taken from a population whose standard deviation is 10. The mean of sample is 40. Test whether the sample has come from a population with mean 38. (5 marks)