MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE COMPUTER SCIENCE

SCO212: PROBABILTY AND STATISTICS FOR COMPUTER SCIENCE

Date: Time: 2 *hours*

Instructions to the Candidate:

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. Independent events (2 marks)
   ii. Sample space (2 marks)

b) Suppose that four-letter words of lower-case alphabetic characters are generated randomly with equally likely outcomes. (Assume that letters may appear repeatedly). How many four-letter words are there in the sample space S? (2 marks)

c) Differentiate between EACH of the following terms as applied in scientific research:
   i. Descriptive and Inferential statistics. (2 marks)
   ii. Null hypothesis and Alternative hypothesis (2 marks
   iii. Type 1 and Type 11 error. (2 marks)

d) The data given below represents the frequency distribution of weights for 60 computer science students.

Mass (kg)	90-99	100-109	110-119	120-129	130-139	140-149	150-159
Number of students	2	6	17	16	12	6	1

i. Calculate the mean (3 marks)
ii. State the modal class (1 mark)
iii. Calculate the median mass (3 marks)

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

X	1	2	3	4	5	6
P (X=x)	11/36	9/36	k	5/36	3/36	1/36

Determine

i. k (2 marks)
ii. Expectation mean (2 marks)
iii. Variance (2 marks)

f) 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. Use the four-step procedure to carry out a test of significance. Use α= 0.05
(5 marks)

Question Two (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) The table given below represents the Resting Metabolic Rate (RMR) which is related to body weight for a sample of 10 individuals who are residents of Machakos county.

Body Weight (kg)	57.6	64.9	59.2	60.0	72.8	77.1	82.0	86.2	91.6	99.8
RMR (kcal/24 hrs)	1325	1365	1342	1316	1382	1439	1536	1466	1519	1639

i. Compute the Pearson's correlation co-efficient between body weight and Resting Metabolic Rate (RMR). (8 marks)
ii. Interpret the correlation coefficient obtained in (i). (2 marks)

iii. Fit a regression line to the data. (6 marks)
iv. What is the expected RMR if a person has body weight of 65 kg? (2 marks)

Question Three (20 *Marks*)

a) If X and Y are independent, proof that X and Y satisfies, $E\,[XY] = E(X).E(Y)$

(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 Four (20 *marks*)

a) 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)

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

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

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

Question Five (20 *marks*)

a) Explain the meaning of the following terms as used in probability theory giving examples.
   i. Mutually exclusive Event (2 marks)
   ii. Random variable (2 marks)

b) 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. Mean (3 marks)

ii. Median (2 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) 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)