



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: PROBABILITY 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 I and Type II 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 $\alpha = 0.05$ (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, prove that X and Y satisfies, $E[XY] = E(X) \cdot E(Y)$ (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 $P(X \leq 2, Y \leq 4)$ (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.

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

- i. Find the constant c (3 marks)
- ii. Find $E(X)$ and $\text{Var}(X)$ (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 $\lambda=1.8$ 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)