



MACHAKOS UNIVERSITY

University Examinations 2022/2023

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SECOND SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 191: PROBABILITY AND STATISTICS FOR IT

DATE: 17/4/2023

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question ONE and ANY OTHER TWO

QUESTION ONE (30 MARKS)

- a) Briefly explain two sampling techniques. (4 marks)
- b) Differentiate between discrete and continuous random variables. (4 marks)
- c) Differentiate between the four measurement scales giving examples (8 marks)
- d) Briefly explain the advantage of diagrammatic presentation of data . (2 marks)
- e) A box of chocolates contains 8 milk chocolates and 4 plain chocolates. A chocoholic eats 3 chocolates. Calculate the probability that
 - i. All three are milk chocolates.
 - ii. Exactly one is a plain chocolate. (6 marks)
- f) Suppose the fat contents (in grams) for eating English breakfasts and meat sandwiches are to be compared. The fat contents are shown below:

Sandwiches	26	17	12	34	7	18	20	21	21	24	6	28	30	13
English breakfast	12	41	25	16	18	45	15	25	36	36	38	14	44	23

Construct a stem and leaf plot to represent this information and interpret the display.
(6 marks)

QUESTION TWO (20 MARKS)

- a) Briefly explain an advantage and disadvantage of questionnaire method of data collection. (2 marks)
- b) The masses of 100 people in 'Keep Fit Town' are shown in the frequency distribution below.

Mass (Kg)	Frequency
53-57	2
58-62	12
63-67	12
68-72	25
73-77	27
78-82	10
83-87	9
88-92	3

From the data, calculate

- Mean
- Variance and Standard deviation
- Median
- Mode
- The minimum acceptable mass if the heaviest 10% of the students are accepted for special weight training. (18 marks)

QUESTION THREE (20 MARKS)

A researcher in residential housing is interested in studying the relationship between income earned and the house size occupied by residents in terms of total floor space in Nakuru Town. A random sample of 10 residents was taken and the data relating their monthly income in thousands Kenya shillings and the house size in hundred square feet was recorded as shown in the table below:

Resident	1	2	3	4	5	6	7	8	9	10
Income	54	75	34	70	12	57	32	15	85	26
House size	10	12	07	15	06	12	10	09	15	08

- Compute the Pearson's product moment coefficient of correlation between the income earned and the house size of the residents. Interpret the result. (10 marks)
- Determine the least squares regression line of the house size on monthly income. Interpret the regression line obtained. (8 marks)
- Using the regression line obtained above, estimate by calculation the size of a house which would be occupied by a typical resident whose salary is Ksh 40,000. (2 marks)

QUESTION FOUR (20 MARKS)

- a) Two fair six faced dice are rolled and the events A, B are defined as follows:

A: The score on the topmost face of the first die is 5.

B: The sum of the scores on the topmost faces of the dice is at least 9.

Determine the following probabilities

- i. $P(A)$ (1 mark)
- ii. $P(B)$ (2 marks)

- b) The female lecturers at a large university recently lodged a complaint about the most recent round of promotions from lecturer to senior lecturer. An analysis of the relationship between gender and promotion was undertaken, with the joint probabilities in the following table being produced:

	Promoted	Not promoted
Female	0.03	0.12
Male	0.17	0.68

- i. If a female lecturer is selected, what is the probability of being promoted? (3 marks)
 - ii. If a male lecturer is selected, what is the probability of being promoted? (3 marks)
 - iii. Is it reasonable to accuse the university of gender bias? (1 mark)
- c) In a certain dance competition, dance groups were to be awarded points on a scale of 1 to 50. The groups were later to be ranked in order to identify and reward the best. Two judges were assigned to assess the groups and award each group points to reflect his assessment. A random sample of 12 groups was taken and the points were as shown in the table below:

Group	1	2	3	4	5	6	7	8	9	10	11	12
Judge 1	12	08	35	44	24	32	35	18	48	25	15	28
Judge 2	24	12	30	40	18	30	25	23	42	30	10	20

- i. Compute the Spearman's rank coefficient of correlation between the points awarded by the two judges. (5 marks)
 - ii. Evaluate the consistency in assessment between the two judges. (1 mark)
 - iii. Give one application of Spearman's Rank Correlation. (2 marks)
- d) Differentiate between correlation and causality. (2 marks)

QUESTION FIVE (20 MARKS)

- a) A student answers 10 questions in a multiple-choice test by guessing each answer. For each question, there are 5 possible answers, only one of which is correct. If we consider a “success” as getting a question right and consider the 10 questions as 10 independent Bernoulli trials, then $X \sim \text{Bin}(10, 0.2)$ where X is the random variable representing the number of correct answers. What is the probability that the student chooses
- i. 3 answers correctly? (3 marks)
 - ii. 7 answers correctly? (2 marks)
 - iii. Fewer than three answers correctly? (3 marks)
 - iv. At least 5 answers correctly? (3 marks)
- b) At a particular restaurant 4 plates are broken, on average, each week. What is the probability that
- i. 2 plates are broken next week? (3 marks)
 - ii. At most 4 plates are broken next week? (3 marks)
 - iii. More than 3 plates are broken next week? (3 marks)