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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
SECOND YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF BUSINESS AND INFORMATION TECHNOLOGY

Date: 28th July, 2022
Time: 11.30am – 1.30pm

KMA 2213 - MATHEMATICAL STATISTICS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Differentiate between the following terms as used in probability and statistics

i) Descriptive and inferential statistics (2 marks)

ii) Parameter and statistic. (2 marks)

iii) Grouped and ungrouped frequency distributions. (2 marks)

b) A student goes to the library. Let events B = the student checks out a statistics book and D = the student checks out a programming book. Suppose that $P(B) = 0.40$, $P(D) = 0.30$ and $P(B \text{ AND } D) = 0.20$. Are B and D independent?

(3 marks)

c) The length of time, in hours, it takes Kiriri University Soccer team to play one soccer match is normally distributed with a mean of two hours and a standard deviation of 0.5 hours. A sample of size $n = 50$ is drawn randomly from the population. Find the probability that the sample mean is between 1.8 hours and 2.3 hours.

(3 marks)

d) The median and mode of the following distribution are given to be 25 and 24. Calculate the missing frequencies and then arithmetic mean of the data:

Marks Obtained	0-10	10-20	20-30	30-40	40-50
No. of Students	14	x	27	y	15

(6 marks)

e) People visiting video shops often buy more than one DVD at a time. The probability distribution for DVD per customer at Plaza Video Shop is given in the following table.

x	0	1	2	3	4	5
P(X=x)	0.03	0.50	0.24		0.07	0.04

i) Find the probability that a customer rents three DVDs

ii) Compute the mean and variance of number of DVDs sold.

(5 marks)

f) On the average, a computer Motherboard lasts ten years. The length of time the computer part lasts is exponentially distributed. What is the probability that the computer part lasts more than 7 years?

(3 marks)

g) The mean price of mid-sized cars in a region is Ksh 540,000. A test is conducted to see if the claim is true. State the Type I and Type II errors in complete sentences.

(4 marks)

QUESTION TWO (20 MARKS)

a) Calculate Population Coefficient of Variation from the following grouped data

Class	20-25	25-30	30-35	35-40	40-45	45-50
frequency	110	170	80	45	40	35

(8 marks)

b) Let X be a continuous random variable with the following pdf

$$f(x) = \begin{cases} cx^2, & -1 < x < 1 \\ 0, & otherwise \end{cases}$$

i) Find the constant c (3 marks)

ii) Find E(x) and Var(x) (6 marks)

iii) Find P(x > 0.5) (4 marks)

QUESTION THREE (20 MARKS)

a) It is estimated that 50% of text messages are spam messages. Some software has been applied to filter these spam messages before they reach your inbox. A certain brand of software claims that it can detect 99% of spam messages, and the probability for a false positive (a non-spam message detected as spam) is 5%. Now if a message is detected as spam, then what is the probability that it is in fact a non-spam message? (5 marks)

b) Based on field experiments, a new variety green gram is expected to give a yield of 12.0 quintals per hectare. The variety was tested on 10 randomly selected farmers fields. The yield (quintals/hectare) were recorded as 14.3,12.6,13.7,10.9,13.7,12.0,11.4,12.0,12.6,13.1. Do the results conform the expectation at 5% level of significance?

(9 marks)

c) Calculate the coefficient of covariance and correlation for the following data:

X	2	8	18	20	28	30
Y	5	12	18	23	45	50

(6 marks)

QUESTION FOUR (20 MARKS)

a) The following are the marks (out of 100) of 60 students in mathematical statistics.

16, 13, 5, 80, 86, 7, 51, 48, 24, 56, 70, 19, 61, 17, 16, 36, 34, 42, 34, 35, 72, 55, 75, 31, 52, 28,72, 97, 74, 45, 62, 68, 86, 35, 85, 36, 81, 75, 55, 26, 95, 31, 7, 78, 92, 62, 52, 56, 15, 63,25, 36, 54, 44, 47, 27, 72, 17, 4, 30.

i) Construct a grouped frequency distribution table with width 10 of each class starting from 0 – 9.

(3 marks)

ii) Represent the data in a histogram.

(3 marks)

Estimate;

iii) Mode. (2 marks)

iv) Quartile deviation. (6 marks)

b) The final exam scores in a statistics class were normally distributed with a mean of 63 and a standard deviation of five

i) Find the probability that a randomly selected student scored more than 65 on the exam.

ii) Find the probability that a randomly selected student scored less than 85

iii) Find the 90^{th} percentile (that is, find the score *k* that has 90% of the scores below *k* and 10% of the scores above *k*).

(6 marks)

QUESTION FIVE (20 MARKS)

a) A group of 5 patients treated with medicine. A is of weight 42,39,38,60 &41 kgs. Second group of 7 patients from the same hospital treated with medicine B is of weight 38, 42, 56, 64, 68, 69, & 62 kgs. Find whether there is any difference between medicines at 5% level of confidence? Assume the observations are normally distributed with equal population variance.

(8 marks)

b) A manufacturer is concerned about the variation of the forces its helmets transmits to wearers when subjected to an external force. The manufacturer has designed so that the mean force transmitted by the helmets is 800 units with a standard deviation to be less than 40 units. Tests were run on a random sample of $n = 40$ helmets, and the sample mean and sample standard deviation were found to be 825 units and 48.5 units, respectively. Do the data provide sufficient evidence, at the alpha = 0.05 level, to conclude that the population standard deviation exceeds 40 units?

(8 marks)

c) Find the G.M for the following data, which gives the defective screws obtained in a factory.

Diameter (cm)	5	15	25	35
Number of defectives	5	8	3	4

(4 marks)