KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
END OF SEMESTER EXAMINATIONS
FOR THE DEGREE OF BACHELOR OF BUSINESS INFORMATION TECHNOLOGY
SPECIAL
KMA 2213 MATHEMATICAL STATISTICS

Date: August 12, 2024
Time: 8:30 am- 10:30am

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE COMPULSORY (30 MARKS)

a)   Suppose that the summary of a sample survey is given by the table below

Class	5-9	10-14	15-19	20-24	25-29	30-34	35-39
Frequency	5	12	32	40	18	10	6

Estimate the;
  i)   Mode.   (2 Marks)
  ii)   Median.   (2 Marks)
  iii) Represent the data in a histogram with a frequency polygon on it.   (3 Marks)

b)   The data on the number of harmful viruses found in ten school computers are; 2, 5, 10, 8, 0, 3, 6, 4, 7 and 12. Find
  i)   Arithmetic mean number of viruses.   (2 Marks)
  ii)   Variance.   (2 Marks)

c)   The data below shows the number of machines and the maintenance cost

No of Machines	10	15	12	17	20	11	8
Maintenance cost (in '000 KES)	25	32	28	38	40	15	18

Find the correlation coefficient between the number of machines and cost f maintenance and comment on it.   (5 Marks)

d)   Suppose that a population income has unknown mean and known variance 62500. From a sample of 100 individuals, the mean income of 4500 was obtained.
  i)   Test whether the population mean income of this population is less than 4000. Take $\alpha = 0.05$.   (5 Marks)
  ii)   Construct 95% confidence interval for the true population mean.   (3 Marks)

e)   The number of complaints received by XYZ company is Poisson distributed with an average of 8 complaints per day. What is the probability that the number of complains received;
  i)   In the following day less than three.   (3 Marks)
  ii)   In the following 5 working days is 15.   (3 Marks)

QUESTION TWO (20 MARKS)

a)   Distinguish between probability and non-probability sampling.   (2 Marks)
b)   Discuss **FOUR** probability sampling designs.   (8 Marks)
c)   The data below show the monthly sales (in 100 units) of a certain shop in the year 2022

Month	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Sales	120	80	60	75	90	65	40	50	62	40	28	50

   Determine the autocorrelation between observations at lag 3.   (6 Marks)

d)   A random variable has a probability distribution given by

x	-1	0	1	2	3
P(X = x)	0.1	0.3	0.4	0.15	0.05

   Obtain the mean and variance of X.   (4 Marks)

QUESTION THREE (20 MARKS)

Suppose a researcher wished to do a study on the ages of the top 50 wealthiest people in the world. The researcher first would have to get the data on the ages of the people. In this case, these ages are listed in Forbes Magazine.

49, 57, 38, 73, 81, 74, 59, 76, 65, 69, 54, 56, 69, 68, 78, 65, 85, 49, 69, 61, 60, 71, 57, 61, 69
48, 81, 68, 37, 43, 78, 82, 43, 64, 67, 52, 56, 81, 77, 79, 85, 40, 85, 59, 80, 61, 83, 90, 87, 74

a)   Organize the data into a grouped frequency table.   (5 Marks)
b)   From the frequency distribution obtained in (a), determine
   i)   Mode.   (3 Marks)
   ii)   Median.   (3 Marks)
   iii) Mean.   (3 Marks)
   iv)   Standard deviation.   (3 Marks)
   v)   Inter-quartile range.   (3 Marks)

QUESTION FOUR (20 MARKS)

a)   A gift shop has three prize wrappers named Lucky, Mercy and Nancy. Out of the gifts sold daily, it has been noted that Lucky and mercy wrap 30% and 40% respectively and the rest are wrapped by Nancy. It has also been identified that Lucky, Mercy and Nancy fails to remove price tags in 2%, 1% and 3% in the items they wrap respectively.
   i)   What is the probability that the item sold has a price tag?   (3 Marks)
   ii) If a customer complains that the gift she bought had a price tag, what is the probability that it was wrapped by Mercy?   (3 Marks)
b)   A personal computer is used for office work at home, research, communication, personal finances, education, entertainment, social networking, and a myriad of other things. Suppose that the average number of hours a household personal computer is used for entertainment is two hours per day. Assume the times for entertainment are normally distributed and the standard deviation for the times is half an hour.

   i)   Find the probability that a household personal computer is used for entertainment between 1.8 and 2.75 hours per day.   (3 Marks)
   ii) Find the maximum number of hours k per day for which 25% of households uses a personal computer for entertainment for k or less hours.   (4 Marks)

c)   Suppose you play a game that you can only either win or lose. The probability that you win any game is 55%. If you play games, what is the probability that you;
   i)   win 15 times?   (2 Marks)
   ii) lose all 20 games?   (2 Marks)
   iii) win at least 17 games?   (3 Marks)

QUESTION FIVE (20 MARKS)

a) Distinguish between;
   i)   Hypothesis and hypothesis testing.   (2 Marks)
   ii) Null and alternative hypotheses.   (2 Marks)
   iii) Type I and type II error.   (2 Marks)
b) Boys of a certain age are known to have a mean weight of $\mu = 85$ pounds. A complaint is made that the boys living in a municipal children's home are underfed. As one bit of evidence, $n = 25$ boys (of the same age) are weighed and found to have a mean weight of $\bar{X} = 80.94$ pounds and a standard deviation σ is 11.6 pounds. As a manager, based on the available data, what should you concluded concerning the complaint? Take $\alpha = 0.05$.
                                                                                         (6 Marks)
c) A psychologist was interested in exploring whether or not male and female college students have different driving behaviours. To do this, he conducted a survey of a random $m = 34$ male college students and a random $n = 29$ female college students. Here is a descriptive summary of the results of her survey:
      Male: $m = 34, \bar{x} = 105.5, \ s_x = 20.1$ Female: $n = 29, \ \bar{y} = 90.9, \ s_y = 12.2$
   Is there sufficient evidence at the $\alpha = 0.05$ level to conclude that the mean fastest speed driven by male college students differs from the mean fastest speed driven by female college students?   (8 Marks)