SECTION A (40 marks)

Answer ALL questions in this section in the spaces provided.

1.   (a)   Outline **three** conditions necessary for a probability distribution to be considered as binomial.

   (3 marks)

   (b)   Define the term *infinite set* as applied in set theory.   (2 marks)

2.   (a)   Using words state the *addition rule* as used in probability.   (2 marks)

   (b)   Expand the following binomial expression using binomial theorem.   (3 marks)

   $$(2x+3y)^4$$

3.   The probability that Morine would sell 10, 20, 30 or 40 fish in a particular day is 0.4, 0.3, 0.2 and 0.1 respectively. Determine the number of fish she is expected to sell in a given day.   (2 marks)

4.   Explain each of the following terms as used in matrices:

   (i)   singular matrix;   (2 marks)

(ii)   inverse matrix .   (2 marks)

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5.   (a)   Using the matrix method, solve the following simultaneous equations.   (2 marks)
             $p + q = 1$
             $q - 2p = 7$

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      (b)   Define the term *binomial theorem* as used in mathematics.   (2 marks)

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6.   Table 1 shows data from the accounts office of a certain company. Use it to answer the question
      that follows.

Year	Amount in Ksh		
	Sales (000)	Gross profit (000)	Net profit (000)
2009	220	60	40
2010	235	65	50
2011	240	75	55
2012	250	80	60

Table 1

Use a multiple bar graph to represent this data. Label the graph appropriately. (4 marks)
Use the grid provided.

7. Using an example in each case differentiate between a *transpose* of a matrix and a *unit* matrix.

(4 marks)

8. Using a diagram, outline the types of kurtosis curves. (4 marks)

9. (a) Using the binomial theorem, determine the fourth term in the following binomial expression.

$$\left[3x - \frac{2}{3}\right]^7$$

(2 marks)

(b)   Outline **two** disadvantages of the *arithmetic mean*.   (2 marks)

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10.   Convert each of the following number systems to their respective equivalence:

(i) 243_{10} to excess-3;   (2 marks)

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(ii) $A45_{16}$ to octal.   (2 marks)

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SECTION B (60 marks)
Answer Any FOUR questions in this section in the spaces provided.

11. (a) Define the term *universal set* as used in set theory. (2 marks)

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(b) Differentiate between *permutation* and *combination* as applied in probability. (4 marks)

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(c) Let $X = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ and $Y = \begin{bmatrix} 3 & 2 \\ 4 & -1 \end{bmatrix}$

Evaluate $(X + Y)^{-1}$ (3 marks)

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(d) Explain **three** types of *bias* that could be applied during data collection. (6 marks)

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12. (a) Differentiate between *explicit function* and *implicit function* as used in mathematics. (4 marks)

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(b) (i) Define the term *random experiment* as used in probability. (2 marks)

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(ii) A basket contains five (5) white and three (3) black marbles. Two (2) marbles are drawn at random one after the other without replacement. Determine the probability that both marbles drawn are black. (3 marks)

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(c) Table 2 shows the age distribution of people in a certain village. Use it to answer the questions that follow.

Age	No of persons (000)
0 - 4	39
5 - 14	91
15 - 29	122
30 - 44	99
45 - 64	130
65 - 74	50
75 - 94	28

Table 2

Determine the following:

(i) mean age of the people;

(ii) standard deviation of the people. (6 marks)

13. (a) Let $A = \{m,n,o,p\}$, $B = \{m,n,o,p,q\}$ and $C = \{m,p,r\}$

Using a Venn diagram in each case, determine the following set operations:

(i) $A \cup B$; (2 marks)

(ii) $A \cap C$. (2 marks)

(b) Using graphical method, solve the following simultaneous equations. (6 marks)

$$y = x^2 - 2x + 1$$
$$y = 5 - 2x$$

Use the grid provided

(c) Ann intends to purchase one tin of potatoes, three bunches of bananas and two baskets of onions. On one hand, at Hurus market, the cost of one tin of potatoes is Ksh 140, a bunch of banana is Ksh 50 and a basket of onions is Ksh 100. On the other hand, at Naks market, the corresponding prices are Ksh 300, Ksh 48 and Ksh 80. Determine the following:

(i) Anns' requirements as a row matrix; (1 mark)

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(ii) the prices in each market as a column matrix; (2 marks)

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(iii) the total cost from each market. (2 marks)

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14. (a) Explain each of the following terms as used in a computer coding system:

(i) 4-bit BCD code; (2 marks)

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(ii) Parity bit; (2 marks)

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(iii) EBCDIC code. (2 marks)

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(b)   Table 3 shows information from Human Resource office of a certain company regarding its employees.

Qualifications	Employees
A level	Smith, Jones, William Brown
Graduates	Smith, Brown
Registered associate members	Smith, William, Merville, Tyler, Moore, Knight

Table 3

Assume set X represents all employees with A-level qualifications, set Y represents all employees registered as associate members and set Z represents all graduates. Use a Venn diagram to represent this information.   (4 marks)

(c)   (i)   Using the two's complement, solve the following binary operation.

$01011100_2 - 11011101_2$ (3 marks)

    (ii)   given the values $x = 10$, $y = 4$ and $z = 2$

Determine the value of P if $P = \dfrac{10y^2 + z^3}{x^2}$ (2 marks)

15. (a) Using the graphical method, present the following inequality

$$y < 3x + 1$$

(4 marks)

Use the grid provided

(b) Use the following sets to answer the questions that follow:

$$P = \{a,b,c,d,e\}, \quad Q = \{c,d,e,f,g\} \quad and \quad R = \{a,c,d,e,g,h\}$$

$$U = \{a,b,c,d,e,f,g,h,i\}$$

Determine the following:

(i) $(P \cup Q) \cap R$; (2 marks)

(ii) $(P \cap Q)$ (2 marks)

(c) Given that:

$$A = \begin{bmatrix} -1 & 4 \\ 1 & 2 \\ 0 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 2 & -4 \\ 1 & 3 & 5 \end{bmatrix} \qquad and \qquad C = \begin{bmatrix} 0 & 3 & -2 \\ -2 & -7 & 6 \end{bmatrix}$$

Show that:

BA + CA = (B + C) A. (4 marks)

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(d)   Outline **three** circumstances under which employees could be required to cope with the
        challenges posed by the emerging of mathematical computer programs.   (3 marks)

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