KASNEB

DICT LEVEL I

COMPUTER MATHEMATICS

MONDAY: 22 May 2017.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Computers store everything as binary digits. Therefore, standard encoding systems are required for each type of data.

In relation to the above statement, explain how the following types of data are represented in a computer:

     (i)   Alphanumeric data.   (2 marks)

     (ii)   Numeric data.   (2 marks)

     (iii)   Negative integers.   (2 marks)

(b) Perform the following operations:

     (i)   Encode the decimal number, 70246 into the 8-4-2-1 BCD code.   (2 marks)

     (ii)   Decode the binary number, 1011 0001 0100 1100 into the 5-4-2-1 BCD code.   (2 marks)

(c) Perform each of the following binary arithmetic operations:

     (i) $11.101 + 110.01 + 111.101 + 1101.1$.   (2 marks)

     (ii) $10101010 - 110011$.   (2 marks)

     (iii) 11100111×11.   (2 marks)

     (iv) $100.0001 \div 10.1$.   (2 marks)

(d) Using packed decimal format, write the codes for each of the following numbers:

     (i)   +3759.   (1 mark)

     (ii)   -3759.   (1 mark)

                                                    (Total: 20 marks)

QUESTION TWO

(a) Convert each of the following numbers to their respective equivalents:

     (i) 41.6875_{10} into binary form.   (2 marks)

     (ii) 12345_{10} into octal form.   (2 marks)

     (iii) 44444_{8} into decimal form.   (2 marks)

     (iv) 2893_{10} into hexadecimal form.   (2 marks)

(b) Find the sum of each of the following octal digits:

     (i) $6 + 7$.   (1 mark)

     (ii) $7 + 7$.   (1 mark)

(c)   Perform each of the following arithmetic operations:

    (i) $45376_8 + 36274_8$.   **(2 marks)**

    (ii) $8D07A5_{16} + 734F6_{16}$.   **(2 marks)**

(d)   Evaluate the following using complements:

    (i) $671354_8 - 213604_8$.   **(2 marks)**

    (ii) $A57913_{16} - 64EE00_{16}$.   **(2 marks)**

(e)   Explain two uses of error detection codes in data representation.   **(2 marks)**
                                                                             (Total: 20 marks)

QUESTION THREE
(a)   Solve for x in each of the following equations:

    (i) $\dfrac{3}{x-1} + \dfrac{4}{x+1} = \dfrac{8}{x+1}$ **(2 marks)**

    (ii) $\dfrac{2x+6}{2x+1} - 3 = \dfrac{5}{2x+1} - \dfrac{1}{3}$ **(2 marks)**

(b)   Mary Munga bought a laptop computer and a printer at a total cost of Sh.22,035.
The laptop computer costs $5\frac{1}{2}$ times as much as the printer.

    Required:
    Determine the cost of a laptop computer and the printer.   **(3 marks)**

(c)   Solve the following simultaneous equations using the substitution method:

    $3y - 2x = 11$
    $y + 2x = 9$ **(3 marks)**

(d)   The admission fee at a football game is Sh.350 for children and Sh.750 for adults. On a certain weekend, 1,500 people attended the football game and Sh.605,000 was collected.

    Required:
    The number of children and adults who attended the football game.   **(4 marks)**

(e)   Construct a truth table for the following proposition:
        $(x \leftrightarrow \bar{y}) \rightarrow (\bar{x} \wedge y)$ **(4 marks)**

(f)   Show that:
    (i)   A logically implies $B \rightarrow A$.   **(1 mark)**

    (ii) $\bar{B}$ logically implies $B \rightarrow A$.   **(1 mark)**
                                                                  (Total: 20 marks)

QUESTION FOUR
(a)   Given the following matrices:

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

    Find:
    (i) $3A - 0.5B$ **(2 marks)**

    (ii) BA **(2 marks)**

(b)   Solve the following equations using the matrix method:

$5x + 3y = 8$

$2x + y = -1$ (4 marks)

(c)   Given the matrices A and B

Show that:
$(AB)^{-1} = B^{-1}A^{-1}$ if both A and B are invertible.   (2 marks)

(d)   The following data show marks obtained in a computer mathematics examination:

Marks (x)	Frequency (f)
0-10	6
10-20	16
20-30	24
30-40	25
40-50	17

Required:
The standard deviation of the marks.   (6 marks)

(e)   There are three bags A, B and C each containing 100 marbles:

- Bag A contains 75 red marbles and 25 blue marbles.
- Bag B contains 60 red marbles and 40 blue marbles.
- Bag C contains 45 red marbles and 55 blue marbles.

A marble is chosen at random from one of the bags.

Required:
Using a tree diagram, find the probability that the chosen marble is red.   (4 marks)
                                                                                   (Total: 20 marks)

QUESTION FIVE
(a)   A survey of 77 students in a university produced the following results:

25 students read newspaper A
19 students read newspaper B
27 students do not read newspaper C
11 students read newspaper A but not newspaper B
11 students read newspaper B and C.
13 students read newspaper A and C.
9   students read all the three newspapers.

Required:
(i)   Present the above information using a venn diagram.   (2 marks)

(ii)   The number of students who read only newspaper C.   (2 marks)

(iii)   The number of students who read none of the three newspapers.   (2 marks)

(iv)   The number of students who read newspaper A and B but not newspaper C.   (2 marks)

(b)   Let $A = \{x, y\}$ and $B = \{x, y, z\}$

Find:
$B \times A$ (1 mark)

(c)   Fill in the blank cells in the table below:

Representation	Base
E F F	Base - 16
	Base - 10
	Base - 2

(2 marks)

(d)   Find the two's compliments of the binary number 10110101.   (1 mark)

(e)   Perform each of the following arithmetic operations:

(i) $1011.11 \div 11$ (2 marks)

(ii) $648 + 487$ in BCD code.   (2 marks)

(f)   The probability of three teams A, B and C winning a volleyball competition are $\frac{1}{3}$, $\frac{1}{5}$ and $\frac{1}{9}$ respectively.

Required:
Find the probability that:

(i)   Either A or B will win the competition.   (1 mark)

(ii)   Either A or B or C will win the competition.   (1 mark)

(iii)   None of the three teams will win the competition.   (1 mark)

(iv)   Neither A nor B will win the competition.   (1 mark)

(Total: 20 marks)