



DICT LEVEL I

COMPUTER MATHEMATICS

MONDAY: 20 May 2019.

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) Perform the following arithmetic operations:
- (i)  $465.37_8 + 31.613_8$ . (2 marks)
- (ii)  $4617263_8 - 1423735_8$ . (2 marks)
- (b) Perform the following hexadecimal operations:
- (i)  $1 + 5 + C$ . (1 mark)
- (ii)  $1 + E + 6$ . (1 mark)
- (iii)  $C868_{16} + 72D9_{16}$ . (2 marks)
- (iv)  $72A4_{16} - 4E86_{16}$ . (2 marks)
- (c) Find the radix – minus – one (15's) complement and the radix (16's) complement for each of the following:
- (i)  $5COF8_{16}$ . (2 marks)
- (ii)  $2A7600$ . (2 marks)
- (d) Convert the decimal number 13.6875 to binary form. (2 marks)
- (e) Perform the following binary operations:
- (i)  $1001 + 1101 + 110 + 1011$ . (2 marks)
- (ii)  $1101.101 - 11.10111$ . (2 marks)
- (Total: 20 marks)

QUESTION TWO

- (a) Find the value of the following matrices:
- (i)  $3 \begin{pmatrix} 2 & -5 & 1 \\ 3 & 0 & -4 \end{pmatrix} - 2 \begin{pmatrix} 1 & -2 & -3 \\ 0 & -1 & 5 \end{pmatrix} + 4 \begin{pmatrix} 0 & 1 & -2 \\ 1 & -1 & -1 \end{pmatrix}$  (4 marks)
- (ii)  $\begin{pmatrix} 1 & 6 \\ -3 & 5 \end{pmatrix} \begin{pmatrix} 4 & 0 \\ 2 & -1 \end{pmatrix}$  (3 marks)
- (b) Find the inverse of matrix **B**.
- $$\mathbf{B} = \begin{pmatrix} 2 & -3 \\ 1 & 3 \end{pmatrix}$$
- (2 marks)

- (c) Given the matrix  $A = \begin{pmatrix} 1 & 2 & 0 \\ 3 & -1 & 4 \end{pmatrix}$  and  $A^T$  being transpose of matrix A:

Find  $AA^T$

(4 marks)

- (d) Consider the following sets:

$$\begin{aligned} A &= \{1\} \\ B &= \{1, 3\} \\ C &= \{1, 5, 9\} \\ D &= \{1, 2, 3, 4, 5\} \\ E &= \{1, 3, 5, 7, 9\} \\ U &= \{1, 2, \dots, 8, 9\} \end{aligned}$$

**Required:**

- (i)  $A \cap (B \cup E)$ . (2 marks)
- (ii)  $(B \cap F) \cup (C \cap E)$ . (3 marks)
- (iii)  $(A \cap D) / B$ . (2 marks)

**(Total: 20 marks)**

### QUESTION THREE

- (a) Let  $p$  be "it is cold" and let  $q$  be "it is raining".

Give a simple verbal sentence which describes the following:

- (i)  $q \vee \sim p$  (1 mark)
- (ii)  $\sim p \vee \sim q$  (1 mark)
- (iii)  $\sim \sim q$  (1 mark)
- (iv)  $q \wedge \sim p$  (1 mark)
- (b) Prove that the operation of disjunction can be written in terms of the operation of conjunction and negation  
 $p \vee q \equiv \sim (\sim p \wedge \sim q)$  (4 marks)
- (c) Show that "p implies q and q implies p" is logically equivalent to the biconditional "p if and only if q" that is  
 $(p \rightarrow q) \wedge (q \rightarrow p) \equiv p \leftrightarrow q$  (3 marks)
- (d) Show that the biconditional  $p \leftrightarrow q$  can be written in terms of the three connectives using  $\vee$ ,  $\wedge$  and  $\sim$  (2 marks)
- (e) Find the internal representation of 907 if the computer uses a 32-bit memory location to store each number. (3 marks)
- (f) Perform the following arithmetic conversions:
- (i)  $43027_8$  to binary form. (2 marks)
- (ii)  $11100.1011011011_2$  to hexadecimal. (2 marks)

**(Total: 20 marks)**

### QUESTION FOUR

- (a) Solve the following linear equations:

- (i)  $6x - 8 + x + 4 = 2x + 11 - 5x$  (2 marks)
- (ii)  $\frac{x-2}{2x+3} = \frac{3}{7}$  (2 marks)

- (b) Solve the following simultaneous equations by elimination method:

(i)  $x - 2y = 5$   
 $-3x + 6y = -10$  (3 marks)

(ii)  $\frac{2x}{3} + \frac{y}{2} = 8$   
 $\frac{x}{6} - \frac{y}{4} = -1$  (4 marks)

(c) In a survey of 60 households in a certain village, the results were as given below:

- 25 households practice coffee farming
- 26 households practice tea farming
- 26 households practice dairy farming
- 9 households practice both coffee and dairy farming
- 11 households practice both coffee and tea farming
- 8 households practice tea and dairy farming
- 8 households practice neither cash crop farming nor dairy farming

**Required:**

- (i) A Venn diagram to represent the above information. (3 marks)
- (ii) The number of households who practice all the three types of farming. (3 marks)
- (iii) The number of households who practice only one type of farming. (3 marks)

**(Total: 20 marks)**

**QUESTION FIVE**

(a) The table below shows marks of a continuous assessment test in computer mathematics:

<b>Marks obtained out of 20</b>	20	19	18	17	16	15	14	13	12	10	9
<b>Number of students</b>	4	6	2	7	1	2	7	2	1	2	1

**Required:**

- (i) The mean mark. (4 marks)
- (ii) The variance of the marks. (4 marks)
- (iii) The standard deviation of the marks. (3 marks)

(b) In Chauringo Business College, 25% of the students failed Mathematics, 15% of the students failed Financial Accounting and 10% of the students failed in both Mathematics and Financial Accounting.

A student was selected at random.

**Required:**

- (i) The probability that the student selected failed Mathematics given that he failed Financial Accounting. (3 marks)
- (ii) The probability that the student selected failed Financial Accounting given that he failed Mathematics. (3 marks)
- (iii) The probability that the student selected failed Mathematics or Financial Accounting. (3 marks)

**(Total: 20 marks)**

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