061306T4CPM

COMPUTER PROGRAMMING LEVEL 6

IT/OS/CP/CR/02/6/A

APPLY DISCRETE MATHEMATICAL CONCEPTS

NOV/DEC 2023

TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

CANDIDATE WRITTEN ASSESSMENT

TIME: 3 Hours

INSTRUCTIONS TO CANDIDATES

1. *The paper consists of **two** sections: **A** and **B***
2. *Answer **ALL** questions in Section **A** and any **Three** from section **B***
3. *Marks for each question are indicated in the brackets*
4. *A separate answer booklet will be provided*
5. *Do not write on the question paper*

Candidates should answer the questions in English

This paper consists of 4 printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing

SECTION A: (40 Marks)

(Answer ALL questions in this section)

1. Define a Boolean function (2 Marks)
2. Highlight FIVE rules of Boolean algebra (5 Marks)
3. Explain THREE types of logic gates (6 Marks)
4. Draw a truth table for a three-input OR gate (Use A and B as the inputs and Q as the output) (5 Marks)
5. Define a set and give TWO examples of sets (5 Marks)
6. Suppose S = {1, 2, 3}, T = {1, 3, 5}, and U = {2, 3, 4, 5}. Then find
    a. S ∪ T (2 Marks)
    b. S ∪ U (2 Marks)
7. Explain THREE types of matrices (6 Marks)
8. If (x + 1, y – 2) = (3, 1), find the values of x and y. (3 Marks)
9. Differentiate between arithmetic and geometric sequences. (2Marks)
10. Define De-Morgan's Theorems as used Boolean Laws. (2Marks)

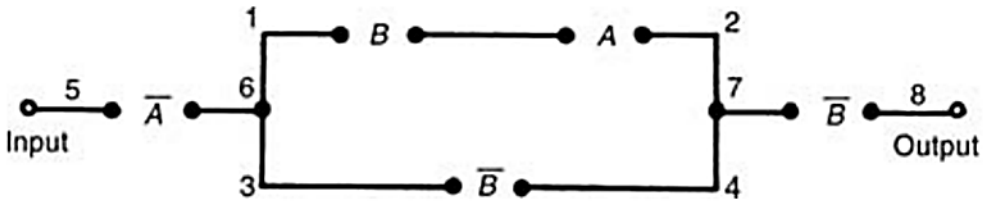
SECTION B: (60 Marks)

(Answer any THREE questions in this section)

11.

a. Using truth tables, describe the OR, NOR, NAND and XOR gates. (8 Marks)

b. Derive the Boolean expression and construct a truth table for the switching circuit shown in figure 1 below (6 Marks)



c. Construct a switching circuit to meet the requirements of the Boolean expression (6 Marks)

$$Z = A \cdot \overline{C} + \overline{A} \cdot B + \overline{A} \cdot B \cdot \overline{C}$$

12.

a. Use matrices to solve the simultaneous equations:

$3x + 5y - 7 = 0, 4x - 3y - 19 = 0$ (4 Marks)

b. Solve for x, y and z using matrices (10 Marks)

i. $x + y + z = 4$
ii. $2x - 3y + 4z = 33$
iii. $3x - 2y - 2z = 2$

c. Simplify (6 Marks)

$$F \cdot G \cdot \overline{H} + F \cdot G \cdot H + \overline{F} \cdot G \cdot H$$

13.

a. Suppose that we have the set $U = \{n : 0 \leq n < 100\}$ of whole numbers as our universal set. Let P be the prime numbers in U, let E be the even numbers in U, and let F = {1, 2, 3, 5, 8, 13, 21, 34, 55, 89}. Describe the following sets either by listing them or with a careful English sentence.

i. E^c (2 Marks)

ii. $P \cap F$ (2 Marks)

iii. $P \cap E$ (2 Marks)

iv. $F \cap E \cup F \cap E^c$ (2 Marks)

v. $F \cup F^c$ (2 Marks)

b. Prove that $A \cup (B \cup C) = (A \cup B) \cup C$ (6 Marks)

c. Giving an example describe a Power set (4 Marks)

14.

a. Prove that the sum of first n odd integers is n^2 (4 Marks)

b. Find the sum of the first 50 terms of the sequence 1, 3, 5, 7, 9, ... (4 Marks)

c. An arithmetic progression has 3 as its first term. Also, the sum of the first 8 terms is twice the sum of the first 5 terms. Find the common difference. (4 Marks)

d.

i. Draw the graph of $y = x^2 + x - 6$ (4 Marks)

ii. Write down the turning point (s) of graph $y = x^2 + x - 6$ (1 Marks)

iii. Use the graph to find the roots of the equation $x^2 - 2x - 3 = 0$ (3 Marks)

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