VIT
Vellore Institute of Technology

Fall Semester – 2019-2020
Continuous Assessment Test – II
Programme Name & Branch : B.Tech./M.Tech.

Course Code & Name : MAT 1014 – Discrete Mathematics and Graph Theory

Slot : A2+TA2+TAA2

Exam Duration : 90 Minutes

Maximum Marks : 50

Answer ALL the Questions

Each question carries equal marks (5 × 10 = 50 Marks)

1. (i) Prove that $\{1, -1\}$ is a normal subgroup of the multiplication group $G = \{1, i, -i, -1\}$.
(ii) Consider the homomorphism f from Z onto Z_n defined by $f(m) = [r]$, where r is the remainder, when m is divided by n. Find $ker(f)$.

[10 M]

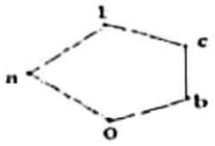
2. Consider the group coding function $e : B^2 \to B^4$ defined by $e(00) = 0000$, $e(10) = 1001$, $e(01) = 0111$ and $e(11) = 1111$. Decode the following words (a) 0011 (b) 1011 (c) 1111.

[10 M]

3. (i) Let $X = \{2, 3, 4, 6, 12, 36, 48\}$ and let R be the relation xRy if x divides y. Draw the Hasse diagram of R.
(ii) Let R be a relation on a set A. Then define $R^{-1} = \{(a, b) \in A \times A | (b, a) \in R\}$. Prove that if (A, R) is a poset then (A, R^{-1}) is also a poset.

[10 M]

4. (i) Verify whether the lattice given by the Hasse diagram in the figure below is distributive.



(ii) Consider the lattice $D_{60} = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$, the divisors of 60 ordered by divisibility.
(a) Draw the diagram of D_{60}.
(b) Find the LUB and GLB of 10 and 15?
(c) Find complements of 2 and 10, if they exist.
(d) Express each number x as the join of a minimum number of irredundant join irreducible elements.

[10 M]

5. (i) Show that the following Boolean expressions are equivalent to one another
(a) $(x \oplus y) \cdot (x' \oplus z) \cdot (y \oplus z)$
(b) $(x \cdot z) \oplus (x' \cdot y) \oplus (y \cdot z)$.
(ii) Simply the Boolean expression $((x_1 + x_2) + (x_1 + x_3)).x_1.\overline{x_2}$ **[10 M]**

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