**AU – 2537**

Third Semester B. E. (Computer Science and Engg.) Examination

# DISCRETE STRUCTURES

Paper – 3 KS 04/3 KE 04

**( USC – 10306 )**

P. Pages : 4

Time : Three Hours ] [ Max. Marks : 80

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**Note :** (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer book must be used for Section A and B in Pharmacy and Cosmetic Tech.
(2) Assume suitable data wherever necessary.
(3) Illustrate your answer wherever necessary with the help of neat sketches.
(4) All questions carry marks as indicated.
(5) Use pen of Blue/Black ink/refill only for writing the answer book.

## SECTION A

1. (a) Show the following equivalences :

(i) $A \rightarrow (B \vee C) \Longleftrightarrow (A \wedge \neg B) \rightarrow C$

(ii) $(P \vee Q) \rightarrow C \Longleftrightarrow (P \rightarrow C) \wedge (Q \rightarrow C)$ 7

(b) Obtain Principle Conjunctive Normal form of

$(\neg P \rightarrow R) \wedge (Q \rightleftarrows P)$ 6

**OR**

2. (a) Prove the following equivalence without using Truth table :

$(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Longleftrightarrow R$ 6

(b) Explain with example :

(i) Tautology

(ii) Contradiction

(iii) Equivalent formulas 7

3. (a) Show that.

$(x)\ (P(x) \longrightarrow Q(x)) \wedge (x)\ (Q(x) \longrightarrow R(x)) \Longrightarrow (x)\ (P(x) \longrightarrow R(x))$ 6

(b) Show that $S \vee R$ is tautological implied by $(P \vee Q) \wedge (P \longrightarrow R) \wedge (Q \longrightarrow S)$. 7

**OR**

4. (a) Determine whether the conclusion C follows logically from premises $H_1$ and $H_2$ :

(i) $H_1 : P \longrightarrow Q \quad H_2 : \neg P \quad C : Q$

(ii) $H_1 : P \longrightarrow Q \quad H_2 : \neg(P \wedge Q)\ C : \neg P$ 7

(b) Symbolize the following statements :

(i) All cats are animals

(ii) Some real numbers are rational. 6

5. (a) Let R and S be the given relations as

$R = \{<1, 2>, <3, 4>, <2, 2>\}$

$S = \{<4, 2>, <2,5,> <3, 1>, <1, 3>\}$

find RoS, SoR, RoR, Ro(SoR), (RoS)oR, RoR, SoS 7

(b) Draw Venn Diagrams of

(i) $A \cup B = A \cup C$ but $B \neq C$

(ii) $A \cap B = A \cap C$ but $B \neq C$

(iii) $A \cup B \subset A \cup C$ but $B \not\subset C$ 7

**OR**

6. (a) Let $P = \{<1, 2>, <2, 4>, <3, 3>\}$ and
$Q = \{<1, 3>, <2, 4>, <4, 2>\}$

Find $P \cup Q$, $P \cap Q$, D(P), D(Q), R(P), R(Q), $D(P \cup Q)$ and $R(P \cap Q)$
Also, show that
$D(P \cup Q) = D(P) \cup D(Q)$ and $R(P \cap Q) \subseteq R(P) \cap R(Q)$. 7

(b) Let X = {1, 2, 3, 4, 5, 6, 7) and R = {<x, y>|(x-y) is divisible by 3}
Show that R is an equivalent relation. Draw the graph of R. 7

## SECTION B

7. (a) What is coset ? Find the left coset of {[0], [3]} in the group $<Z_6, +_6>$. 6

(b) Convert the following infix expressions to prefix and postfix :

(i) (A + B)/(C–D)

(ii) (A*B) + (C* (D/F)) 7

**OR**

8. (a) Write down the composition table for

(i) $<Z_7, +_7>$

(ii) $<Z_7, *_7>$ 7

(b) Explain :

(i) Group

(ii) Semi-Group

(iii) Monoid 6

9. (a) For the following function : F = x + y +z
Give

(i) Circuit diagram

(ii) Truth -Table representation

(iii) k-map representation. 7

(b) Prove the following Boolean identities,

(i) a + (a' * b) = a + b

(ii) a * (a' + b) = a * b 7

**OR**

10. (a) Draw lattice diagram of $<S_n, D>$ for n = 12, 24, 45 7

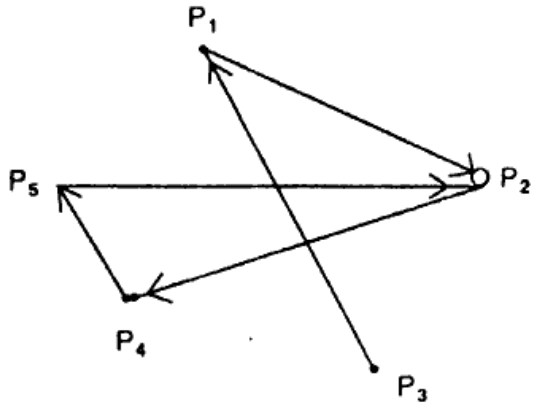
(b) Use k-map representation to find minimal sum of product expressions for

(i) $f(a, b, c) = \Sigma(0, 1, 4, 6)$

(ii) $f(a, b, c, d) = \Sigma(0, 5, 7, 8, 12, 14)$ 7

11. (a) Show that in a complete binary tree the total number of edges is given by $2(n_t - 1)$, where $n_t$ is the number of terminal nodes. 7

(b) Obtain adjacency matrix and path matrix of the digraph given below :

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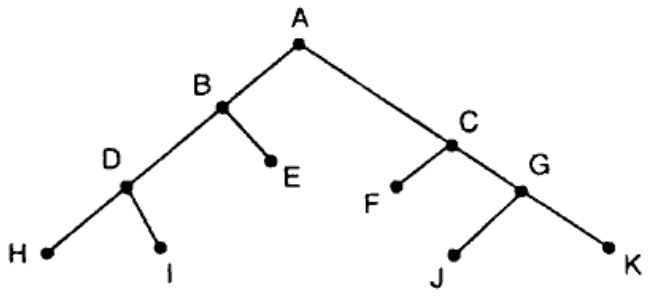
**OR**

12. (a) Give the directed tree representation of the following formula

$(P \vee (\neg P \wedge Q)) \wedge ((\neg P \wedge Q) \wedge \neg R)$ 6

(b) Traverse the following with three techniques :

inorder, preorder, postorder

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