



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 997302

Roll No.

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B. Tech.

(SEM. III) (ODD SEM.) THEORY
EXAMINATION, 2014-15
DISCRETE STRUCTURES

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all the questions. Each question carry equal marks.

1 Attempt any **FOUR** questions : **5×4=20**

- (a) Out of 450 students in a school, 193 students read Science and 200 students read Commerce, 80 Students read neither. Find out how many read both?
- (b) Define distributive lattice and complimented lattice. Show that the lattice (L^3, \leq) of 3 tuples of 0 and 1 is complemented.
- (c) Let R be relation given by on set $A = \{1, 2, 3, 4, 5\}$.
 $R = \{(1, 1), (1, 4), (1, 5), (2, 3), (2, 5), (3, 1), (3, 2), (3, 3), (4, 2), (4, 3), (5, 3)\}$. Find the reflexive, Symmetric and transitive closure of R.

- (d) Let f, g and $h: R \rightarrow R$ be defined by $f(x)=x+2$, $g(x)=1/(x^2+1)$, $h(x)=3$
 Compute (i) $f^1(g(x))$ (ii) $hf(gf^1).h(f(x))$.
- (e) Prove by the principle of mathematical induction

$$P(n): P(n) = 1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}$$

2 Attempt any **TWO** questions : 10×2=20

- (a) Let $(G, *)$ be a group, where $*$ is usual multiplication operation on G . Then show that for any $x, y \in G$ following equation holds
- (i) $(x^{-1})^{-1} = x$
 (ii) $(xy)^{-1} = y^{-1}x^{-1}$.
- (b) (i) Prove that the set $S = \{0, 1, 2, 3\}$ forms a ring under addition and multiplication modulo 4 but not a field.
 (ii) Define the following with suitable example: Cyclic group, Zero divisor of ring.
- (c) Let $G = \{1, -1, i, -i\}$ with the binary operation multiplication be an algebraic structure, where $i^2 = -1$,
- (i) Determine whether G is an abelian.
 (ii) If G is cyclic group, then determine the generator of G .

3 Attempt any **TWO** questions : 10×2=20

- (a) Define a Boolean function of degree n . Simplify the following Boolean expression using K- maps
 $xyz + x\sim yz + \sim x\sim yz + \sim xyz + \sim x\sim y\sim z$.
- (b) Draw hasse diagram for divisibility relation on following set $A = \{3, 4, 12, 24, 48, 72\}$.
- (c) How are sequential circuits different from combinational circuits? Draw the logic circuit corresponding to Boolean expression $Y = A + BC + B$.

4 Attempt any **TWO** questions : 10×2=20

- (a) (i) Differentiate between tautology and contradiction with suitable examples.
 (ii) Show that the statements :
 $P \rightarrow Q$ and $\neg Q \rightarrow \neg P$ are logically equivalence.
- (b) Prove the validity of the following argument :
 If I get the job and work hard then I will get promoted.
 If I will get promoted, then I will be happy. I will not be happy therefore either I will not get the job or I will not work hard.
- (c) The contrapositive of a statement S is given as "If $x < 2$ then $x+4 < 6$ " Write the statement S and its converse.

5 Attempt any **FOUR** questions : 5×4=20

- (a) Solve the recurrence relation.
 $f(k) = f(k-2) + f(k-1)$ $f(0) = 0$ $f(1) = 1$
- (b) What is recursion and recurrence relation? Solve the following recurrence relation
 $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$
 with the conditions $a_0 = 2$, $a_1 = 5$, $a_2 = 15$
- (c) Determine the G.F of a numeric function a_r where
- $$a_r = \begin{cases} 2^r & \text{if } r \text{ is even} \\ -2^r & \text{if } r \text{ is odd} \end{cases}$$
- (d) Find the number of integer solutions of the equation
 $X_1 + X_2 + X_3 + X_4 + X_5 = 30$
 Where $X_1 \geq 2$, $X_2 \geq 3$, $X_3 \geq 4$, $X_4 \geq 2$, $X_5 \geq 0$
- (e) What is a binary search tree? Form a binary search tree for the words vireo, warbler, egret, grosbeak, nuthatch, and kingfisher.