NMCA-114

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

PAPER ID : 214120

Roll No.

M.C.A.

(SEM. I) (ODD SEM.) THEORY EXAMINATION, 2014-15

DISCRETE MATHEMATICS

Time : **3** Hours]   [Total Marks : **100**

Note :   Attempt all questions.

1   Attempt any **four** of the following :   5×4=20

   (a)   Show that relation "xRy iff $(x - y)$ is divisible by 5" is an equivalence relation on the set of integers.

   (b)   In a class of 120 students, 80 students study mathematics, 45 study history and 30 students study both the subjects. Find the number of students who study neither mathematics nor history.

(c) Given

$R = \{(1,1),(2,2),(2,3),(3,3),(3,4),(4,3),(3,1)\}$ for

$A = \{1,2,3,4\}$ make its relation matrix M_R and check whether it is symmetric, reflexive or transitive.

(d) If $A = \{1,3,4\}, B = \{2,3,4\}, C = \{1,2,3\}$ then find $(A \times B) - (A \times C)$ and $(B \times C) \cap (B \times A)$.

(e) Let P and Q be two sets. If $P \rightarrow Q$ is one-one onto, then prove that $f^{-1} : Q \rightarrow P$ is also one-one onto.

2   Attempt any **four** of the following :   5×4=20

(a) Show that G = $\{0,1,2,3,4\}$ is a cyclic group under addition modulo 5.

(b) Find product of two permutations

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 1 & 2 & 3 \end{pmatrix} \text{ and } \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 1 & 4 & 3 & 6 & 5 \end{pmatrix}$$

check whether it is odd or even.

(c) Show that in a group identity element is unique.

(d) Prove that quotient group of an abelian group is abelian.

(e) Show that Kernel is a normal subgroup in group isomorphism.

3   Attempt any **two** of the following :   10×2=20

(a) Express the expression $xy'+xz+xy$ in CN as well as DN form.

(b) Draw the Hasse diagram of $(P(S), \subseteq)$ where $S = \{\alpha, \beta, \gamma\}$, and show that it is a lattice.

(c) For every element a and b in a Boolean algebra show that (i) $(a.b)' = a'+b'$

(ii) $(a+b)' = a'.b'$.

(d) From the input/output table given below form a corresponding Boolean expression and make it's simplified circuit.

Input x_1	Input x_2	Output $f(x_1, x_2)$
1	1	1
1	0	1
0	1	0
0	0	1

4   Attempt any **two** of the following :   10×2=20

(a) Show that $(p \Rightarrow (q \wedge r)) \Rightarrow (\neg r \Rightarrow \neg p)$ is a tautology. Using truth table and without truth table.

(b) Test the validity of the following argument "If I enjoy studying, then I will study. I will do my homework or I will not study. I will not do my homework. Therefore, I do not enjoy studying."

(c) Show that $(p \Rightarrow q) \wedge (r \Rightarrow q) \equiv (p \vee r) \Rightarrow q$.

5   Attempt any **two** of the following :   **10×2=20**

(a)   Solve the recurrence relation T (1) = 1,

$T(n) = 3T(n/3) + n.$

(b)   (i)   In a shipment there are 40 floppy disks
of which 5 are defective. Determine in
how many ways we can select (i) five
non-defective floppy disks (ii) five floppy
disks in which exactly three are defective.

(ii)   Show that every complete bipartite graph
is two colorable.

(c)   Write notes on the following :

(1)   Generating function

(2)   Planar graph.

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