Total No. of Questions : 5]

SEAT No. :

**P1384**

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# [5623]-1004

## F.Y. B.Sc. (Computer Science)

## MATHEMATICS

## MTC - 112 : Discrete Mathematics

## (2019 Pattern) (Paper - II)

*Time : 2 Hours]* *[Max. Marks : 35*

***Instructions to the candidates:***

1) *Q.1 is compulsory.*
2) *Solve any three questions from Q.2 to Q.5.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams must be drawn whenever necessary.*
5) *Use of single memory, non-programmable scientific calculator is allowed.*

***Q1)*** Attempt any five of the following : **[5]**

a) Write the Negation of the statement : $\forall x, \left(x^2 > x\right)$.

b) Determine if the poset $(D_{30}, /)$ is a Boolean algebra.

c) Define : Partial order relation.

d) How many bit strings of length 8 contain exactly three 1's?

e) How many different license plates are available if each plate contains a sequence of three letters followed by three digits?

f) Find the two terms $a_2$ and $a_3$ of the sequence defined by the following Recurrence relation :

$$a_n = a_{n-1} + 3a_{n-2},\ a_0 = 1,\ a_1 = 2.$$

***Q2)*** a) Show that the hypothesis "If it rains then I wear a raincoat," "If it shines then I do not need a sweater," "Either it rains or it shines", "Moreover, I do need a sweater", lead to the conclusion, "I wear a raincoat". (Use rules of inference). **[6]**

OR

Consider a Boolean expression. **[6]**

$E(x, y, z) = (\bar{x} \wedge z) \vee (y \wedge z)$

Find Disjunctive Normal form of the expression.

b) Define a relation 'R' on set of non-zero real numbers $\mathbb{R}$ as **[4]**

'$x$R$y$ if and only if $xy > 0$'.

Show that R is an equivalence relation.

***Q3)*** a) i) Let $[L, \vee, \wedge]$ be a bounded and distributive lattice.

Prove that : If a complement of an element exists, then it is unique. **[4]**

ii) Find the complement of each element of a lattice ($D_{20}$, $l$), if exists. **[2]**

OR

Let A = {1, 2, 3, 4, 5}. Define a relation R on A as **[6]**

R = {(1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (4, 1)}

Find the transitive closure of R using Warshall's algorithm. Also draw the diagraph.

b) Solve the following Recurrence relation. **[4]**

$a_r - 20a_{r-1} + 100a_{r-2} = 0$, $a_0 = 1$, $a_1 = 20$.

***Q4)*** a) Find the number of integers between 200 and 500 (both inclusive) which are divisible by 2 or 3 or 7? **[6]**

OR

Show that if any five numbers from 1 to 8 are chosen, then two of them will add to 9. **[6]**

b) Let A = {1, 2, 3, 4, 5}. Determine the truth values of each of the following statements. **[4]**

i) $\exists x \in A \left(x+3=12\right)$

ii) $\forall x \in A \left(x+3<12\right)$

iii) $\exists x \in A \left(x+3=5\right)$

iv) $\forall x \in A \left(x+3 \le 8\right)$

***Q5)*** Attempt any two of the following : **[10]**

a) Prove that : $\sqrt{2}$ is an irrational no. by indirect method.

b) In how many ways 20 different toys can be distributed among 5 children so that

i) two children get 7 toys each and remaining 3 children get 2 each.

ii) each get 4 toys.

c) Find the particular solution of the recurrence relation.

$a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1.$

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