GUJARAT TECHNOLOGICAL UNIVERSITY MCA - SEMESTER-III • EXAMINATION - SUMMER - 2017

Subject Code: 3630001 **Subject Name: Basic Mathematics** Time:02:30 pm - 05:00 pm

Date: 02/06/2017

Total Marks: 70

03

02

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.

(a) Show the following equivalences without constructing the truth table Q.1

- $(\neg P \land (\neg Q \land R)) \lor (Q \land R) \lor (P \land R) \Leftrightarrow R$ 04 (i)
- $\neg (P \land Q) \rightarrow (\neg P \lor (\neg P \lor Q)) \Leftrightarrow (\neg P \lor Q)$ (ii) 03 02
- State Peano's axioms. **(b)** (i)
 - (ii) Prove that 1+2+3+...+n = n(n+1)/2
 - Show that $n^3 + 2n$ is divisible by 3 (iii)

(a) Define: Maximal Compatibility Block. Let the compatibility relations on the **Q.2** 07 sets $\{1, 2, 3, 4, 5, 6\}$ and $\{x_1, x_2, \dots, x_6\}$ be given by following two matrices respectively. Construct the graph and find the maximum compatibility blocks.

(i)	2	1						(ii))	x ₂	1				
	3	1	1							X 3	1	1			
	4	1	1	1						X 4	0	0	1		
	5	0	1	0	0					X5	0	0	1	1	
	6	0	0	1	0	1				X6	1	0	1	0	1
		1	2	3	4	5					x ₁	x ₂	X3	X 4	X5

(b) Construct the truth tables for the following formulas

 $((P \rightarrow (Q \rightarrow R)) \rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R)))$ (i) 04

(ii)
$$(P \land Q) \lor (\neg P \land Q) \lor (P \land \neg Q) \lor (\neg P \land \neg Q)$$
 03

(b) Define Relation. Let $X = \{1, 2, 3, 4\}$ and $R = \{\langle x, y \rangle | x \rangle \rangle$. Draw the graph 07 of R and also give its matrix.

Draw the Hasse diagrams of the following sets under the partial ordering 07 Q.3 **(a)** relation "divides" and indicate those which are totally ordered. $\{1,2,3,4\}$ (ii) $\{3,5,15\}$ (iii) {2,4,8,16} (i) (iv) {1,2,3,6,12} (v) $\{2,3,6,12,24,36\}$ (b) (i) For A = $\{2, 3, 4, 5, 6\}$, B = $\{3, 4, 5, 6, 7\}$, C = $\{4, 5, 6, 7, 8\}$ find 04 b) $(A \cap B) \cup (A \cap C)$ a) $(A \cup B) \cap (A \cup C)$

(ii) Define Power Set. Find the Power Set of the set $Q = \{1, \{2, 3\}, 4\}$ 03 OR

Q.3 **(a)** Define Composition of a function. Let $X = \{1,2,3\}$ and *f*,*g*,*h* and *s* be functions 07 from X to X given by $f = \{<1,2>,<2,3>,<3,1>\}$ $g = \{<1,2>,<2,1>,<3,3>\}$ $h = \{ <1, 1 >, <2, 2 >, <3, 1 > \}$ $s = \{ <1, 1 >, <2, 2 >, <3, 3 > \}$ Find fog, gof, fohog, sog, gos, sos

(b) What is Recursive Function? Write a Recursive algorithm to find out Fibonacci 07 series.

- (a) Define equivalence relation. Let $X = \{1, 2, ..., 7\}$ and 07 **Q.4** $R = \{\langle x, y \rangle \mid x \cdot y \text{ is divisible by } 3\}$. Show that R is an equivalence relation. Draw the graph of R. 07
 - (**b**) Find the inverse of the matrix

$$\mathbf{A} = \left(\begin{array}{ccc} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{array} \right)$$

OR Explain with example injective (onto), surjective(one-to-one) and bijective(one-07 **Q.4** (a) to-one onto) function. Let N be set of Natural numbers including zero. Determine whether the function given below is injective, surjective or bijective. $f(i) = i^2 + 2$ $f: N \rightarrow N$

(b) (i) If
$$A = \begin{bmatrix} 0 & -1 \\ 1 & -1 \end{bmatrix}$$
 Show that $A^3 = I$ and so find A^{-1}
(ii) Show that $\begin{pmatrix} 3 & 4 \\ 2 & 4 \end{pmatrix}$ is the inverse of $\begin{pmatrix} 3 & 4 \\ 2 & 4 \end{pmatrix}$

(ii) Show that
$$\begin{pmatrix} 3 & 4 \\ 2 & 3 \end{pmatrix}$$
 is the inverse of $\begin{pmatrix} 3 & -4 \\ -2 & 3 \end{pmatrix}$ 03

- (i) Define Cyclic graph, Null graph, and Strongly connected graph. Q.5 (a) 03 (ii) Define Adjacency matrix and path matrix of a graph. Explain each with 04 example.
 - (b) Define a unilateral component and strong component. Write unilateral and strong 07 and weak components of the Graph given in following figure.



OR

- Q.5 Define a directed tree. Draw the graph of the tree represented by 07 **(a)** (A(B(E(H)(I))(F(J)(K))(G(L)))(C(M(O))(N(P)(Q)))(D(R(S(V))(T)(U)))Obtain the binary tree corresponding to it.
 - (i) Define a path in graph. Define length of the path. What is difference between **(b)** 03 a simple path and an elementary path?

(ii) Define isomorphic graphs. State whether the following graphs are 04 isomorphic or not.


