

B. C. A. (First Semester) Examination, 2017-18

Paper Third

BCA - 503

[Mathematical Foundation of Computer Science]

Time: Three Hours]

[Maximum Marks : 70

Attempt any five questions. All questions carry equal marks.

a) Let $A = \{0, 1, 2, 3, 4\}$. Show that the relation $R = \{(0, 0), (0, 4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)\}$ is an equivalence relation. Find the distinct equivalence classes of R . 7

b) Let $A = \{1, 2, 3, 6\}$. If for $x, y \in A$
 $R = \{(x, y) : x \leq y\}$
 $S = \{(x, y) : x \text{ divides } y\}$

Write R and S as sets and find $R \cap S$. 7

a) Let R be the set of all real number and $F : R \rightarrow R$ be function such that $F(x) = \sin x$. $\sin x, x \in R$ and $g(x) = x^2, x \in R$. Then show $g \circ F = f \circ g$. 7

b) Let $F(x) = (2x + 5)$ and $g(x) = x^2 + 1$. Describe $F \circ F$ and FF . 7

a) Use mathematical induction to prove that $1 + 2 + 3 + \dots + n = n(n + 1) / 2$ for all positive integers n . 7

b) Let $(\{a, b\})$ be semi group where $a * a = b$. Show that :
 (i) $a * b = b * a$ (ii) $b * b = b$ 7

a) Show that set $G = \{a + \sqrt{2}b : a, b, \in Q\}$ is a group with respect to addition. 7

b) Find the generating function of the 2, 5, 13, 35,

a) Show that the four matrices :

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \quad \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

Form a multiplicative group. Is this abelian?

b) If the inverse of an element 'a' in a group is a^{-1} , then the inverse of a^{-1} is a, i.e., $(a^{-1})^{-1} = a$. 7

Q6. (a) Prove that $(P \vee q) \wedge (\sim P) \wedge (\sim q)$ is a contradiction.

(b) Prove that $(P \Rightarrow q) \vee r \Leftrightarrow [(P \vee r) \Rightarrow (q \vee r)]$ is a tautology.

Q7. (a) Solve the recurrence relation of $a_n = 5a_{n-1} + 6a_{n-2}, n \geq 2, a_0 = a_1 = 3$.

(b) Let $A = \{a, b, c\}$, show that $(P(A), \subseteq)$ is a poset and draw its Hasse diagram.