# BRAINWARE UNIVERSITY

**Course – BCA**

**Mathematics I (BCA103)**

(Semester – 1)

**Time allotted: 3 Hours** **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

## Group –A

(Multiple Choice Type Questions) 10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) The proposition $p \wedge p$ is equivalent to

a. 1 b. p

c. ~p d. None of these

(ii) If A and B are two sets then $A \cup (A \cap B)$ equals

a. A b. B

c. $\emptyset$ d. None of these

(iii) If n(A)=17, n(A$U$B)=35 and n(A∩B)=8 then n(B) equals

a. 20 b. 26

c. 60 d. 44

(iv) If A is a non-null matrix then $(A^T)^T$ is equals

a. $A^T$ b. $A^{2T}$

c. A d. None of these

(v) Transpose of a row matrix is a

a. Null matrix b. Diagonal matrix

c. Column matrix d. Square matrix

(vi) An onto function is also known as

a. Injective function b. Surjective function

c. Bijective function d. None of these

(vii) The relation { (1,2), (1,3), (3,1), (1,1), (3,3), (3,2), (1,4), (4,2), (3,4)} is

a. Reflexive b. Symmetric

c. Transitive d. Asymmetric

(viii) The set O of odd positive integers less than 10 can be expressed by _____.

a. {1, 2, 3} b. {1, 2, 5, 9}

c. {1, 3, 5, 7, 9} d. {1, 5, 7, 9, 11}

(ix) Solution of $a_n = 3a_{n-1}$ is

a. $a_n = 3$ b. $a_n = 3^n$

c. $a_n = n$ d. None of these

(x) A graph with one vertex and no edges is

a. Multigraph b. Digraph

c. Isolated graph d. Null graph

## Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. Prove the following using truth table:

$$(p \wedge q) \equiv p \vee q$$ [5]

3. Using principle of mathematical induction prove that

$$1.2 + 2.3 + 3.4 + \cdots + n(n+1) = n(n+1)(n+2)/3$$ [5]

4. Define partition of a set. Give an example. [3+2]

5. If the function $f: R \to R \wedge g: R \to R$ are defined by

$$f(x) = 3x - 4, g(x) = -3x + 2$$

Then verify whether $f \circ g = g \circ f$ [5]

6. Define complete graph and regular graph. Give an example of each. [2.5+2.5]

## Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) If $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$, verify that $A^2 - 4A + 3I = 0$ and hence find $A^{-1}$ [5+3]

(b) If $A = \{4,5,7,8,10\}, B = \{4,5,9\}$ *and* $C = \{1,4,6,9\}$ then show that

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ [5]

(c) Define power set. [2]

8. (a) Solve the recurrence relation
$a_n = 4(a_{n-1} - a_{n-2})$ with initial condition $a_0 = a_1 = 1$ [7]

(b) Find the generating function of the sequence
$$a_k = (k+1)3^k$$ [5]

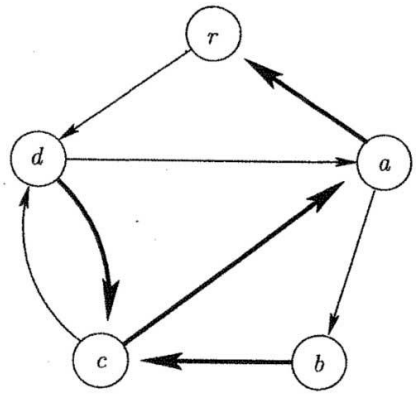
(c) Define proper subset. Give an example. [3]

9. (a) If $R$ is a relation defined by
$$R = \{(x, y): x - yisdivisibleby5\}$$
Prove that $R$is an equivalence relation. [6]

(b) Obtain the principal conjunctive normal form of
$$(p \rightarrow r) \wedge (q \leftrightarrow p)$$ [6]

(c) Define onto mapping. Give an example. [3]

10. (a)




Find the in degree and out degree of each vertex. [5]

(b) A computer company must hire 20 programmers to handle system programming jobs and 30 programmers for application programming. Of those hired, 5 are expected to perform jobs of both types. How many programmers must be hired? [5]

(c) What is bipartite graph? Explain with an example. [5]

11. (a) Express the following matrix as a sum of a symmetric and a skew-symmetric matrix.
$$\begin{bmatrix} -1 & 7 & 1 \\ 2 & 3 & 4 \\ 5 & 0 & 5 \end{bmatrix}$$ [6]

(b) Use generating function to solve the recurrence relation
$$a_n - 9a_{n-1} + 20a_{n-2} = 0, a_0 = -3, a_1 = -10$$ [9]