Total Pages : 4 MC(A)/UG/S–I/2017

End Semester Examination of Semester–I, 2017

Subject : BCA

Paper : BCA–104 (Discrete Math)

Full Marks : 70

Time : 3 Hrs

The figures in the margin indicate the marks corresponding to the question

Candidates are requested to give their answers in their own word as far as practicable.

Illustrate the answers wherever necessary.

Group A

1. Answer **any five** out of eight questions : 2x5=10

   i) Find the transitive closer of the relation $R = \{(a, b), (b, a), (b, c), (d, a), (c, d)\}$ defined over the set $A = \{a, b, c, d\}$.

   ii) Determine the coefficient of x^9y^3 in $(x+y)^{12}$.

   iii) Define recurrence relation and generating function.

   iv) Solve the difference equation $a_r - 3a_{r-1} + 2a_{r-2} = 0$

   v) Define tautologies and contingency.

   vi) Construct the truth table for the statement

   $$(p \wedge \sim q) \vee (q \vee (\sim p \wedge q)).$$

   vii) Define Hamiltonian graph.

viii) Let $f:\mathbb{R}\to\mathbb{R}$ be defined by $f(x)=x^2,\ x\in\mathbb{R}$. Examine whether is subjective or not. [Where $\mathbb{R}$ denotes the set of all real numbers].

Group B

Answer **any five** out of seven questions : 5x4=20

2. Let X and Y be two non-empty sets and let $f: X\to Y$ is an into mapping and also $A\subseteq X$, $B\subseteq X$ then prove that $f(A\cap B)\subseteq f(A)\cap f(B)$.

3. If R be a binary relation defined as : $R=\{(a, b)\in R : a-b\leq 3\}$, determine whether R is reflexive, symmetric and transitive.

4. Prove by mathematical induction
$$\frac{1}{1.3}+\frac{1}{3.5}+\frac{1}{5.7}+....+\frac{1}{(2n-1)(2n+1)}=\frac{n}{2n+1}.$$

5. Prove that a connected graph G is a tree iff adding an edge between any two vertices in G creates exactly one circuit.

6. A shelf holds n books in a row. How many ways are there to choose r books so that no two adjacent books are chosen?

7. Given that $A\cap B=A\cap C$ and $A^C\cap B=A^C\cap C$. Is it necessary that $B=C$? Justify your answer.

8. Suppose 4 letters are to be placed in addressed envelope. Find the number of ways such that no letter is placed in the right envelope.

Group C

Answer **any four** out of six questions: 10x4=40

9. a) Establish the validity of the arguments 5

$$\begin{array}{l} p \Rightarrow r \\ \sim p \Rightarrow q \\ q \Rightarrow s \\ \hline \therefore \sim r \Rightarrow s. \end{array}$$

b) Explain any one of traversal techniques in a graph faxing a suitable example. 5

10. a) Express Fibonacci sequence of numbers 1, 1, 2, 3, 5, 8, 13, 21, ... in term of

i) general expression for the rth number a_r and

ii) generating function.

b) Define graph. Prove that the number of vertices of odd degree in a graph is always even. 5+5

11. a) Prove that if $f : X \to Y$ and $g : Y \to Z$ be two one-to-one onto function, then (gof) is also one-to-one onto function.

b) Prove that $1^2 - 2^2 + 3^2 - \ldots\ldots + (-1)^{n+1}n^2$

$$= \frac{(-1)^{n+1} n(n+1)}{2}$$

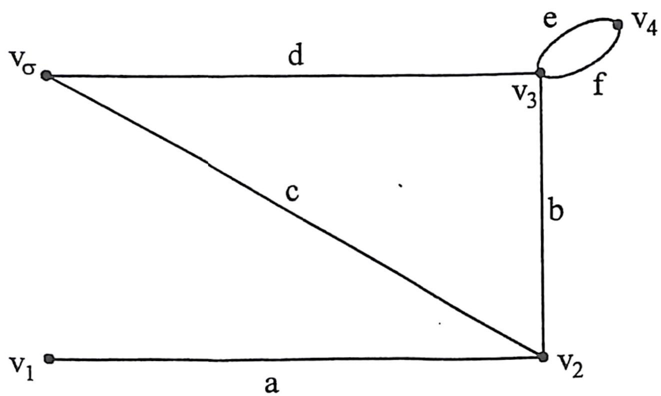
12. a) If function $f:\mathbb{R} \to \mathbb{R}$ be defined by $f(x) = x^2 + 1$, then find $f^{-1}(-8)$ and $f^{-1}(17)$. [$\mathbb{R}$ denotes the set of Real numbers]

b) Show that simple graph with n vertics and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. 5+5

13. a) A relation ρ is defined on the set z is "aρb if and only if a – b is divisible by 6". Prove that ρ is an equivalence relation on z. [Where z denotes the set of integer numbers]

b) Prove that any minimal set of edges containing at least one edge of every spanning tree of a connected graph G is a Cut-Set of G. 5+5

14. a) Find the incidence matrix of the following graph.



b) Define Directed graph, Directed circuit, Binary Tree.

5+2+1+2