End Semester Examination of Semester-I, 2019
Subject : BCA
Paper : BCA-104 (ARR)
(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 : $(5\times 2 = 10)$

i) Define proposition with example.
ii) What is the truth table of $P \Leftrightarrow Q$?
iii) Write the statement of Mathematical Induction?
iv) Define union and intersection of two set.
v) Prove the following using Venn Diagram :
$$(A \cap B)^c = A^c \cup B^c$$
vi) What do you mean by isomorphic graph?
vii) Define Euler graph.
viii) Define a complete graph with example.

Group B

Answer any five out of seven questions: $(5\times 4 = 20)$

2.Construct a graph which is both regular and bipartite. What do you mean by tautology? Give example. (2+2)

3.Prove that the sum of the degrees of the vertices of any finite graph is even.

4. Define Partial order relations. Prove that 'divides' is a Partial order relation (i.e., R_b^a holds if a divides b).

5. If R be a relation in the set of integers Z defined by $R = \{(x, y): x \in Z, y \in Z \text{ and } x - y \text{ is divisible by } 3\}$. Describe distinct equivalence classes of R.

6. Prove that simple graph with n vertices and k components can have atmost $\frac{(n-k)(n-k+1)}{2}$ edges.

7. It is known that in colleges 60% professors play Tennis, 50% of them play Football, 70% Cricket, 20% play Tennis and Football, 40% play Football and Cricket and 30% play Tennis and Cricket. What is the percentage of the professors play all the three games?

8. Find the generating functions of the following sequence in closed form 1, 2, 3, 4, 5, 6, 7

Group C

Answer any four out of six questions: $(4 \times 10 = 40)$

9. (i) Check the nature of the following relation: R_b^a holds iff $|a - b| \leq 2$ over the set of natural numbers.

(ii) Prove the following using mathematical induction:

$1 + 2 + 2^2 + 2^3 + \cdots + 2^n = 2^{n+1} - 1$ for all $n \geq 0$

(iii) Prove that the mapping from R to R defined by $f(x) = x^3 + 1$ is a bijective mapping. (3+4+3)

10. If a binary tree has height h then prove that (i) number of leaves is 2^h (ii) number of nodes is 2^{h+1}-1.

Prove that a graph is a tree iff it is minimally connected.

Draw two Kuratowski's graph. (2+3+3+2)

11. What is the Konigsberg Bridge problem? Draw the corresponding multigraph. Define the degree of a vertex and regular graph. Draw a graph on the following degree sequence {1,4,3,3,3}.

(2+2+3+3)

12. In a class, out of 50 students, 20 students failed in English, 18 failed in Mathematics and 12 failed in both. So what is the number of students who failed at least in one subject? Solve the problem using set theory.

How many 2-digits numbers greater than 40 can be formed by using the digits 1, 2, 3, 4, 5, 6, 7

(i) when repetition is allowed

(ii) when repetition is not allowed

(5+5)

13. What do you mean by minimum spanning tree? Write an algorithm to find the minimum spanning tree. Explain with example. (2+5+3)

14. Briefly discuss different graph representation techniques. Write the procedure of BFS with example. (5+5)