

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [2015-18]

B.A./B.Sc. THIRD SEMESTER (July – December) 2016

Mid-Semester Examination, September 2016

Date : 10/09/2016

Time : 11 am – 1 pm

COMPUTER SCIENCE (Honours)

Paper : III

Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

(Answer any three questions)

[3×5]

1. a) If A, B, C are three non-empty sets, then prove that $A - (B \cap C) = (A - B) \cup (A - C)$. [3]
b) Find the power sets of the following set: $\{1, \phi, \{\phi\}\}$. [2]
2. Write down and prove the general inclusion-exclusion principle. [2+3]
3. a) If the function $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by
 $f(x) = 3x - 4, x > 0$
and $-3x + 2, x \leq 0$, determine $f^{-1}(2)$. [2]
b) If R be a relation on the set of integers, defined as $aRb \Rightarrow 2a+3b$ is divisible by 5, show that R is an equivalence relation. [3]
4. a) Using Warshall algorithm, find the matrix of transitive closure of the relation
 $R = \{(1,1), (1,3), (2,3), (2,4), (3,2), (3,4), (4,1)\}$ [3]
b) What do you mean by Fuzzy set? [2]
5. a) Show that the set of all positive rational numbers form an abelian group under the composition
* defined by $a*b = ab/2$. [4]
b) Define Cyclic group. [1]

Group – B

(Answer any two questions)

[2×5]

6. a) Define edge disjointed subgraph with a suitable example. [2]
b) Show ring-sum operation on two graphs with proper example. [3]
7. a) Draw a graph in which an Euler Line is also a Hamiltonian circuit. What can you say about such graph in general? [3]
b) Provide some real world scenarios which depict the Hamiltonian circuit phenomenon. [2]
8. a) Define Arbitrarily Traceable Graph. [2]
b) Prove that if a connected graph G is decomposed into two subgraph g_1 and g_2 , there must be one vertex common between g_1 and g_2 . [3]

Group – C

(Answer any two questions)

[2×5]

9. a) Find the output of the following code: [2]

```
int sum(int x, int y, int z=0, int w)
{
    return (x + y + z + w);
}
```

```
int main()
{
    cout << sum(10, 15, 16) << endl;
    cout << sum(10, 15, 25, 16) << endl;
    return 0;
}
```

- b) Give an example where 'main()' function can be used as a friend function. State the restrictions imposed on friend function. [2+1]
10. a) Why '?' operator can't be overloaded? [1·5]
 b) Describe the concept of Nested class with suitable example. What do you mean by Qualifier class? [3+0·5]
11. State whether 'this' pointer is suitable for static member function? Mention three circumstances where compiler may not perform inlining. [2+3]

Group – D

(Answer **any three** questions)

- [3×5]
12. For a given Binary tree, write a function to print all the nodes at level **k** where **k** and **the root** of the tree are the only input to the function. [5]
13. A height balanced binary tree satisfies the following property:
 "The **heights** of the two child subtrees of any node **differ by at most one**."
 For a given binary tree, check whether it is height balanced or not. [5]
14. What are the differences between a binary search tree and an AVL tree? Construct an AVL tree with the following set of characters. Show each steps.
 E, J, P, M, Q, N, Y, U, S, W [5]
15. Define a **min-heap**. Given the following ten numbers, construct a **max-heap** showing each steps.
 5, 10, 15, 13, 17, 14, 27, 21, 19, 22 [5]

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