RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [2014-17]

B.A./B.Sc. THIRD SEMESTER (July – December) 2015

Mid-Semester Examination, September 2015

Date : 14/09/2015 **COMPUTER SCIENCE (Honours)**

Time : 11 am – 1 pm Paper : III Full Marks : 50

[Use a separate answer book for each group]

Group – A

1. Explain with example (**any two**) : [2×2·5]
   a) Lexicographic order b) Complemented Lattice c) Bijective function

Answer **any one** question : [1×10]

2. a) Prove or disprove $(A-B)\times C=(A\times C)-(B\times C)$, A, B, C are three non-empty sets. [3]
   b) Let A be some fixed 10-element subset of {1,2,3,..., 50} Show that A possesses two different 5-element subset, the sums of whose element are equal. [3]
   c) Find the recurrence relation and initial condition to find the number of n-bit valid codewords of decimal digits, where valid codeword represents the number with even number of zero(0)s. [4]

3. a) Let x be a real number, show that $\lfloor 2x \rfloor = \lfloor x \rfloor + \lfloor x + y_2 \rfloor$ [2]
   b) How many relations on a set with n elements are (i) symmetric? (ii) reflexive and symmetric? [5]
   c) Check whether the poset $(Z^+, /)$ is a lattice or not. [3]

Answer **any one** of the following : [1×10]

4. a) What is the difference between "maximum path" and "maximal path" in a graph? [2]
   b) Prove that maximum number of edges in graph G with n vertices and k components is $\frac{(n-k)(n-k+1)}{2}$. [3]
   c) Define graph isomorphism with example. [2]
   d) Prove that every simple graph with n vertices $(n \geq 2)$ has atleast two vertices of equal degree. [3]

5. a) Prove that a connected graph G is Eulerian if and only if every vertex has even degree. [3]
   b) Find the maximum number of edges in a bipartite graph with n vertices. [2]
   c) A simple graph G has degree sequence $(d_1, d_2, ..., d_n)$. What is the degree sequence of the complement graph of G? [2]
   d) Prove that if G is a simple graph in which every vertex has degree at least k, then G contains a path of length at least k. If $k \geq 2$ then G also contains a cycle of length at least k+1. [3]

Group – B

Answer **any one** from the following : [1×10]

6. a) "Inline functions can only be defined within the class" —Justify. [2]
   b) What do you mean by Embedded object? Why should we use this? [2+1]
   c) Is it possible to call a constructor from another constructor of the same class? If not, then suggest a technique to combine two constructors of the same class into one single constructor. [3]
   d) If we use 'friend' keyword, does it violate the 'Encapsulation' Property? Justify. [2]

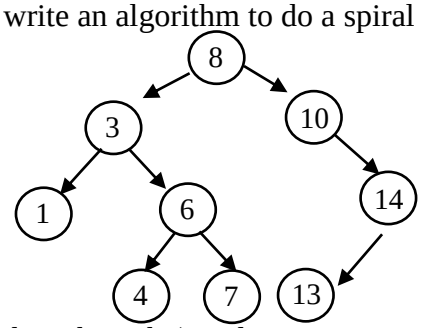
7. a) What do you mean by "name mangling"? [2]
   b) What do you mean by virtual base class? How can it be used to solve ambiguity problem occurred due to hybrid inheritance? [3]
   c) What do you mean by pseudo constructor? [2]

d) Find the output of the following code : [3]

```
Class A
   {
        int x;
             Public :
                  A ( )
                  {
                   }
        A (int i)
        {
             x = i
        }
   };
Class B
   {
        int y, z:
             Public :
                  B ( )
                  {
                  }
        B (int i, int j)
        {
             y = i;
             z = j;
        }
        void add (A     a)
        {
             B b1;
             b1.z = a.x + y;
             cout <<b1.z ;
        }
   };
int main ( )
   {
        A ob(5);
        B ob1 (4, 6);
        ob1. add (ob);
        return 0;
   }
```

Answer **any three** of the following : [3×5]

8. Write an algorithm to find all the leafs of a given binary tree. The only input is the root of the tree. [5]
9. For the following binary tree, the spiral traversal is :
   Given the root of a binary tree, write an algorithm to do a spiral traversal of the binary tree. [5]



8 – 3 – 10 – 1 – 6 – 14 – 4 – 7 – 13

10. Given two values k1 and k2 (where k1 < k2) and a root pointer to a Binary Search Tree. Write an algorithm to print all the keys of the tree in range k1 to k2. i.e print all x such that k1 < x < k2. Efficient algorithm will be given extra credit. [5]
11. Write an algorithm to check whether a binary tree is a binary search tree or not. [5]

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