RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. THIRD SEMESTER EXAMINATION, DECEMBER 2017

SECOND YEAR [BATCH 2016-19]

Date : 12/12/2017 **COMPUTER SCIENCE [Honours]**

Time : 11 am – 3 pm **Paper : III** Full Marks : 75

Group – A

Answer <u>any one</u> question from <u>Question Nos. 1 & 2</u> : [1×5]

1. In how many ways 3 boys and 2 girls can be seated at a round table if
   a) There is no restriction
   b) All the four girls do not seat together
   c) No two girls seat together
   d) All shall not have same neighbours in any two arrangements [5]

2. Show that $a = \{1, -1, i, -i\}$ where $i = \sqrt{-1}$ is an abelian group with respect to multiplication as a binary operation. [5]

Answer <u>any two</u> questions from <u>Question Nos. 3 to 6</u> : [2×10]

3. a) Solve the Generating Function Method : $a_r - 5a_{r-1} + 6a_{r-2} = 2^r + r$ for $n \geq 2$ given $a_0 = 1$, $a_1 = 1$. [5]
   b) Find a recurrence relation and given initial conditions for the number of bit strings of length n that does not contain the pattern 11. [3]
   c) Determine the generating function of the following sequence : $a_r = (x+1)3^r$. [2]

4. a) Prove that if any 30 people are selected, then we may choose a subset of 5 so that all 5 were born on the same day of the week. [2]
   b) Let $A \in \square$. Consider the following relation R on A : aRb if and only if $2a + 3b \neq b$. Find R. [3]
   c) In a game show there are three doors. Behind any of these, only one door has a prize, the prize is kept randomly without the prior knowledge of the player. The host asks the player initially to choose a door. After a player chooses one, host reveals one of the other doors which doesn't contain the prize. Now the contestant is given a chance either to stick to his previous choice or switch to a new one. Which strategy do you think the player must pick to gain maximum probability of winning? Give reason. [5]

5. a) Determine whether the relation R on the set of A is reflexive, irreflexive, symmetric, assymetric or anti-symmetric. A = set of all real numbers; aRb is and only if $a^2 + b^2 = 4$. [5]
   b) If R is a ring such that $a^2 = a \ \forall a \in R$. Prove that—(i) $a + a = 0 \ \forall a \in R$ (ii) $a + b = 0 \Rightarrow a = b$. [5]

6. a) Find the Expectation and Variance of Binomial Random Variables. Give a proper justification and reference for the theorem used. [5]
   b) Using Warshall's algorithm, find the matrix of transitive closure of the relation $R = \{(1,1),(1,4),(2,1),(2,2),(3,4),(4,4)\}$ on the set $A = \{1,2,3,4\}$. [5]

Group – B

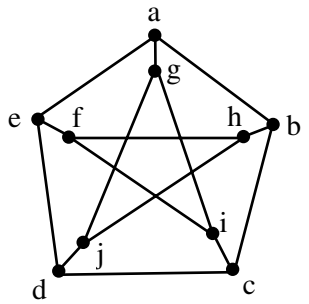
Answer <u>any one</u> question from <u>Question Nos. 7 & 8</u> : [1×5]

7. Explain the following terms with example.
   a) Arbitrarily Traceable Graph [2·5]
   b) Complete Bipartite Graph [2·5]

8. a) What do you mean by fusion of two vertices in a graph? Explain with example. [2·5]
   b) How can you determine the radius of a graph? Give example. [2·5]

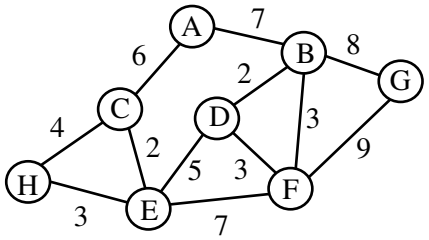
Answer <u>any one</u> question from <u>Question Nos. 9 to 11</u> : [1×10]

9. a) Explain the Ring Sum operation on graph with an example. [2]
   b) Prove that there are no self-complementary graph of order 3, but there are such graphs of order 4 and 5. [3]
   c) Check whether the following graph is Eulerain, Hamiltonian or contains Eulerian trail or not.

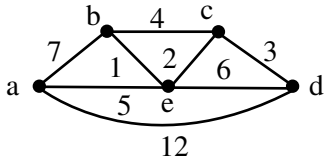


   Give reasons behind you answer. [4]
   d) Explain the term Path Matrix. [1]

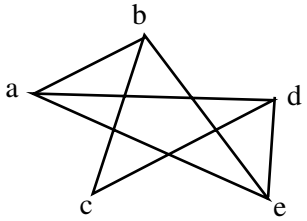
10. a) What do you mean by circuit matrix? Give example. Write down also some properties of it. [2+1]
   b) Find the chromatic polynomial and hence find chromatic number for the graph $K_{3,3}$. [2+1]
   c) Find out the Minimum Spanning Tree of the following graph using Prim's Algorithm. [4]



11. a) Using Dijkstra's algorithm determine the shortest path between vertices a to d from following graph. [3]



   b) What do you mean by perfect matching? [1]
   c) Using matching minimize the following boolean expression
   $F = abcd + a\bar{b}cd + \bar{a}bcd + \bar{a}\bar{b}cd + abc\bar{d} + ab\bar{c}\bar{d}$. [3]
   d) Draw the geometrical dual of following graph. [3]



Group – C

Answer <u>any one</u> question from <u>Question Nos. 12 & 13</u> : [1×5]

12. a) Explain the difference between an object and a class. [2]
    b) How does object oriented programming overcome the shortcomings of traditional programming approaches? [3]

13. a) Explain the term "Data Abstraction & Information Hiding" with proper example. [3]
    b) How Inheritance can help in code reuse? [2]

Answer <u>any one</u> question from <u>Question Nos. 14 & 15</u> : [1×10]

14. a) What are use of Scope Resolution Operator in C++. [2]
    b) Explain the term Copy Constructor with proper example. [3]
    c) What do you mean by function overloading? Explain with suitable example. [3]
    d) When will you make a function inline? Why? [2]

15. a) What are the advantages of new operator over malloc ( )? [2]
    b) How is polymorphism achieved at (i) compile time (ii) run time? [4]
    c) What is virtual base class? Explain with suitable example. [3]
    d) What is friend function? [1]

Group – D

Answer <u>any two</u> questions from <u>Question Nos. 16 to 19</u> : [2×10]

16. a) Prove that total no. of edges of a Complete Binary Tree with n terminal nodes is $2*(n-1)$. [2]
    b) Write down the property of a Heap. How can Heap be represented? [2+1]
    c) Construct a Min Heap using the array 7, 11, 3, 23, 13, 39, 41, 9, 77, 15, 20. Hence perform the heap sort. [2+3]

17. a) Write the following function—
        i) Insertion in Threaded Binary Tree. [4]
        ii) Deletion of a node from a BST. (Consider all 3 cases). [4]
    b) Explain the terms Linear and Coalesced chaining. [2]

18. a) Construct AVL tree using nodes :13, 17, 65, 93, 27, 34, 71, 89, 25, 3, 18. [4]
    b) Write a function to implement the following :
        i) Inorder Traversal of BST. [3]
        ii) DFS. [3]

19. a) Suppose a file contains six different characters and the different characters appear with the following frequencies :

A	B	C	D	E	F
6	9	94	45	12	20

    Use Huffman Coding technique to compress the data. [4]
    b) Briefly discuss about linear probing and quadratic probing method in Hashing. [1·5+1·5]
    c) Compare and contrast between B Tree and B^+ Tree. [3]

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