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Paper Code : CS-302

DATA STRUCTURE AND ALGORITHM

Time Allotted: 3 Hours | *Full Marks*: 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: 1×10=10

(i) Maximum possible height of an AVL Tree with 7 node is

(a) 12 (b) 4

(c) 5 (d) 3

(ii) In a circularly linked list organization, insertion of a node involves the modification of

(a) no pointer (b) 1 pointer

(c) 2 pointers (d) 3 pointers

(iii) A B-tree is

(a) always balanced (b) an ordered tree

(c) a directed tree (d) All of these

(iv) Number of nodes in a complete binary tree of depth k is

(a) 2^k (b) $2k$

(c) $2^k - 1$ (d) None of these

(v) To make a queue empty, elements can be deleted till

(a) front=rear+1 (b) front=rear–1

(c) front=rear (d) None of these

(vi) BFS constructs

(a) a minimal cost spanning tree of a graph. (b) a depth first spanning tree of a graph.

(c) a breadth first spanning tree of a graph. (d) None of these

(vii) A vertex of in-degree zero in a directed graph is called

(a) Articulation point (b) Sink

(c) Isolated matrix (d) Root vertex

(viii) In a height balanced tree the heights of two sub-trees of every node never differ by more than

(a) 2 (b) 0

(c) 1 (d) –1

(ix) Inserting a new node after a specific node in a doubly linked list requires

(a) four pointer exchanges. (b) two pointer exchanges.

(c) one pointer exchanges. (d) no pointer exchanges.

(x) A non-planar graph with minimum number of vertices has

(a) 9 edges, 6 vertices (b) 6 edges, 4 vertices

(c) 10 edges, 5 vertices (d) 9 edges, 5 vertices

Group – B
(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Write an algorithm for inorder traversal of a threaded binary tree.

3. Compare and contrast linked list with static and dynamic array.

4. Write an algorithm to insert a data X immediately before a specific data item Y in a single linked list.

5. What is Load Factor? Why do we need hashing? How does a hash table allow O(1) searching? Why is a prime number chosen for computing a hash function? 1+1+2+1=5

6. Insert the following keys into a B-Tree of given order mentioned below:

a, f, b, k, h, m, e, s, r, c. (Order 3)

a, g, f, b, k, d, h, m, j, e, s, I, r, x, c, l, n, t, u, p. (Order 5) 2+3=5

Group – C
(Long Answer Type Questions)
Answer *any three* of the following. 15×3=45

7. What are sparse matrices? How such a matrix is represented in memory? What are the types of sparse matrices?

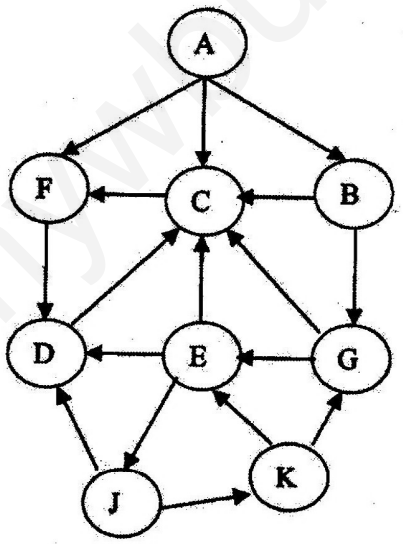
Show that the function f(n) defined by
f(1) = 1
f(n) = f(n–1) + 1/n for n>1, has the complexity O (log n)
Let the size of the elements stored in an 8×3 matrix be 4 bytes each. If the base address of the matrix is 3500, then find the address of A [5, 2] for both row major and column major cases. 2+2+2+4+5=15

8. (a) What do you mean by external sorting? How does it differ from internal sorting?

(b) Write an algorithm for sorting a list numbers in ascending order using selection sort technique.

(c) Describe Kruskal's minimal spanning tree algorithm. 3+7+5=15

9. What is expression tree? Draw the expression tree and write the In, Pre & Post-Order traversals for the given expression tree: E = (2x + y) (5a –b)^3. Prove that the number of odd degree vertices in a graph is always even. Apply BFS/DFS Algorithms and find out the path of the given graph:



2+2+1+1+1+3+5=15

10. (a) Define circular queue.

(b) Write an algorithm to insert an item in circular queue.

(c) What is input restricted dequeue?

(d) Write an algorithm to convert an infix expression to postfix using stack. 2+5+2+6=15

11. Write short notes on *any three* of the following: 5×3=15

(i) AVL Tree

(ii) Heap Sort

(iii) DFS

(iv) Tail recursion

(v) Binary Search Tree
