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B.Tech DEGREE EXAMINATION, DECEMBER 2023

Third Semester

18AIC202J - DATA STRUCTURE AND ITS APPLICATIONS

(For the candidates admitted during the academic year (2020-2021 & 2021-20222))

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours **Max. Marks: 100**

PART - A (20 × 1 = 20 Marks) Marks BL CO

Answer **all** Questions

1. Which data structure allows deleting elements from the front and inserting elements at the back efficiently? — 1 — 1 — 1
   (A) Array (B) Linked List
   (C) Stack (D) Queue
2. What is the time complexity for searching an element in a binary search tree? — 1 — 1 — 1
   (A) O(1) (B) O(log n)
   (C) O(n) (D) O(n log n)
3. Which sorting algorithm has the best average-case time complexity? — 1 — 1 — 1
   (A) Bubble Sort (B) Insertion Sort
   (C) Merge Sort (D) Selection Sort
4. Which of the following is not a type of tree? — 1 — 1 — 1
   (A) Binary Tree (B) AVL Tree
   (C) Heap Tree (D) Linked Tree
5. What is the value of the postfix expression 6 3 2 4 + – * ? — 1 — 1 — 2
   (A) 1 (B) 40
   (C) 74 (D) -18
6. What happen when an element is pushed into the stack when the stack already have five elements and stack size of 5, then stack becomes — 1 — 1 — 2
   (A) Overflow (B) Crash
   (C) Underflow (D) User flow
7. Which of the following is not the application of stack? — 1 — 1 — 2
   (A) A parentheses balancing program (B) Tracking of local variables at run time
   (C) Compiler Syntax Analyzer (D) Data Transfer between two asynchronous
8. Which of the following is incorrect with respect to binary trees? — 1 — 1 — 2
   (A) Let T be a binary tree. For every k ≥ 0, there are no more than 2k nodes in level k (B) Let T be a binary tree with λ levels. Then T has no more than 2λ – 1 nodes
   (C) Let T be a binary tree with N nodes. Then the number of levels is at least ceil(log (N + 1)) (D) Let T be a binary tree with N nodes. Then the number of levels is at least floor(log (N + 1))
9. What is the maximum height of an AVL tree with p nodes? — 1 — 1 — 3
   (A) p (B) log(p)
   (C) log(p)/2 (D) p/2

10. B-tree of order n is a order-n multiway tree in which each non-root node contains 1 1 3
(A) at most (n – 1)/2 keys
(B) exact (n – 1)/2 keys
(C) at least 2n keys
(D) at least (n – 1)/2 keys

11. What is the best case height of a B-tree of order n and which has k keys? 1 1 3
(A) logn (k+1) – 1
(B) nk
(C) logk (n+1) – 1
(D) klogn

12. If a simple graph G, contains n vertices and m edges, the number of edges in the Graph G' (Complement of G) is 1 1 3
(A) (n*n-n-2*m)/2
(B) (n*n+n+2*m)/2
(C) (n*n+n-2*m)/2
(D) (n*n-n+2*m)/2

13. Given graph G having V vertices and E edges which is connected and has no cycles, which of the following statements is true? 1 1 4
(A) V = E
(B) V = E+1
(C) V = E / 2
(D) V = E-1

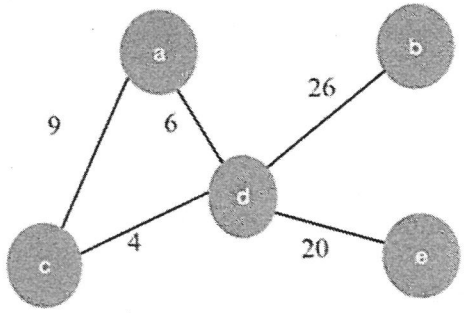
14. Time Complexity of Breadth First Search is? (V – number of vertices, E – number of edges) 1 1 4
(A) O(V + E)
(B) O(V)
(C) O(E)
(D) O(V*E)

15. Consider the graph M with 3 vertices. Its adjacency matrix is shown below. Which of the following is correct: 1 1 4

$$M = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

(A) Graph M has no minimum spanning tree
(B) Graph M has a unique minimum spanning trees of cost 2
(C) Graph M has 3 distinct minimum spanning trees, each of cost 2
(D) Graph M has 3 spanning trees of different costs

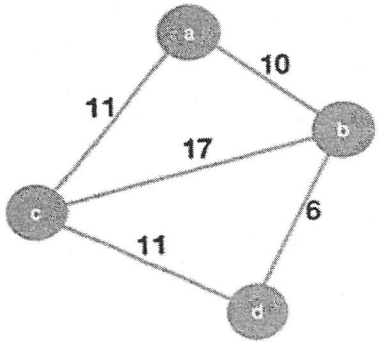
16. Consider the graph shown below. Which of the following are the edges in the MST of the given graph? 1 1 4



(A) (a-c)(c-d)(d-b)(d-b)
(B) (c-a)(a-d)(d-b)(d-e)
(C) (a-d)(d-c)(d-b)(d-e)
(D) (c-a)(a-d)(d-c)(d-b)(d-e)

17. Consider a complete graph G with 4 vertices. The graph G has ____ spanning trees. 1 1 5
(A) 15
(B) 8
(C) 16
(D) 13

18. What is the weight of the minimum spanning tree using the Prim's algorithm, starting from vertex a? 1 1 5



(A) 23 (B) 28
(C) 11 (D) 27

19. Which of the following is not a technique to avoid a collision? 1 1 5
(A) Make the hash function appear random (B) Use the chaining method
(C) Use uniform hashing (D) Increasing hash table size

20. Which of the following is the hashing function for separate chaining? 1 1 5
(A) H(x)=(hash(x)+f(i)) mod table size (B) H(x)=hash(x)+i2 mod table size
(C) H(x)=x mod table size (D) H(x)=x mod (table size * 2)

PART - B (5 × 4 = 20 Marks) **Marks BL CO**

Answer **any 5** Questions

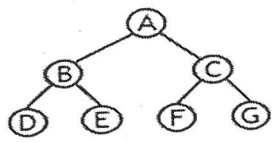
21. What is a linked list? Describe the suitable routine segments for any four operations. 4 1 1

22. List an algorithm to perform the following operations in a doubly linked list. 4 1 1
Insert a node at the end of the list

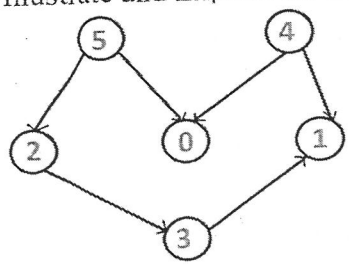
23. What are the two methods to find the time complexity for an algorithm ? Give example . 4 1 2

24. Explain the Infix notation and convert the following infix expression to postfix, expression: 4 1 3
A * (B + C) – D / E

25. Explain the Binary Tree Traversal Methods. Find In-order, Pre-order, Post-order traversal 4 1 3



26. Illustrate and Explain the Topological sort of the below graph. 4 1 4



27. What is hashing and what are applications of the hashing? What are the challenges in designing a hash function? Explain with suitable Examples. | 4 | 1 | 5

PART - C (5 × 12 = 60 Marks) | **Marks** | **BL** | **CO**

Answer **all** Questions

28. (a) What are the merits and demerits of array implementation over linked lists? Illustrate with proper codes and examples. | 12 | 1 | 1

(OR)

(b) Given a set of marks of 'n' students in a class, write a program to find the median mark of the class.

29. (a) Write a program with a function which takes head pointer and value to be inserted as arguments to insert the values in a sorted doubly linked list and display the updated list. | 12 | 1 | 2

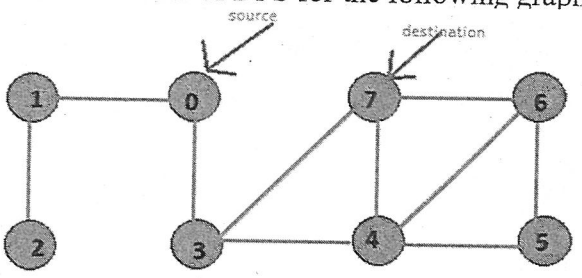
(OR)

(b) Storing of sparse matrices need extra consideration-Justify. How are sparse matrices stored efficiently in the computer's memory?

30. (a) Explain the AVL Trees and different type of AVL Trees. Construct AVL tree using the following sequence of data: 2, 7, 4, 9, 1, 5, 8, 3, 6. | 12 | 1 | 3

(OR)

(b) Write an algorithm which does depth first search through an un-weighted connected graph. In an unweighted graph, would breadth first search or depth first search or neither find a shortest path tree from some node? Why? Write the result of DFS for the following graph.



31. (a) Write an algorithm for heap sorting and explain with example. Mention the applications of heap sorting. | 12 | 1 | 4

(OR)

(b) Write the Kruskal's algorithm to construct minimum spanning tree for the following graph.

32. (a) Given the input { 4371, 1323, 6173, 4199, 4344, 9679, 1989 } and a hash function of h(X) = X (mod 10) show the resulting: a. Separate Chaining hash table | 12 | 1 | 5

(OR)

(b) For a hash table of size:9 with the hash function h(x) = x mod 9, insert the following elements 5, 28, 19, 15, 20, 33, 12, 17, 10. Illustrate the contents of hash table, how the collisions are resolved using

1. Linear Probing 2. Double hashing, where the second hash function is h2(x) = 7 - (x mod 7).

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