B.Tech. DEGREE EXAMINATION, JUNE 2023

Second Semester

18CSC162J - DATA STRUCTURES AND ALGORITHMS

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

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 40 minutes.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours

Max. Marks: 100

Part - A (20 × 1 Marks = 20 Marks)
Answer **All** Questions

	Marks	BL	CO

1. Two main measures of the efficiency of an algorithm are — 1, 1, 1
   (A) Processor and memory
   (B) Complexity and capacity
   (C) Time and space complexity
   (D) Data and space

2. How is the 2nd element in an array accessed using pointer notation? — 1, 2, 1
   (A) *a+2
   (B) *(a+2)
   (C) *(*a+2)
   (D) &(a+2)

3. Assume that the size of integer data type is 4 bytes. Find out the total space required to store the data — 1, 2, 1
```
#include<stdio.h>
int main()
{
int a=5, b=5, c;
c=a + b;
printf("%d", c);
}
```
   (A) 10
   (B) 8
   (C) 12
   (D) 11

4. ADT refers to — 1, 1, 1
   (A) ADT = Type + variable Names + Behaviour of each function
   (B) ADT = Type + Function Names + Behaviour of each function
   (C) ADT = Type + Function Names
   (D) ADT = Type + Behaviour of each function

5. Comment on the following pointer declaration. int *ptr, p; — 1, 1, 1
   (A) ptr is a pointer to integer, p is not
   (B) ptr and p, both are pointers to integer
   (C) ptr is pointer to integer, p may or may not be
   (D) ptr and p, both are not pointers to integer

6. Mr. Kumar worked in a warehouse, and his job role was to arrange boxes in a fixed range. His senior asked to pick the box from the warehouse, but there were no more boxes. Find the exceptional message when Kumar tries to find a box in an empty warehouse. — 1, 2, 2
   (A) Overflow
   (B) Underflow
   (C) NULL
   (D) EMPTY

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28. a) In the bank passbook, eight transactions were recorded on 12th April. Mr. ABC wants to check the transaction details using the transaction number "12206". Develop an efficient binary search algorithm and apply that search technique to retrieve transaction information for the given Data: 12201, 12202, 12203, 12204, 12205, 12206, 12207, 12208. — 12, 3, 1

    (OR)

    b) Consider the following data: DATA: -2, 45, 0, 11, - 9 (a)Use the bubble sort technique to arrange these data elements in increasing order.

29. a) Given two polynomials represented by a linked list $5x^2 + 4x^1 + 2x^0$ and $-5x^1 - 5x^0$, write a procedure to add two polynomials — 12, 2, 2

    (OR)

    b)Explain the insertion and deletion operation of circular queue with example.

30. a) Define binary search tree? Construct the same using given elements 50, 40, 10, 30, 20, 100, 80, 90, 70, 60. — 12, 4, 3

    (OR)

    b)Define AVL Tree? Construct the same by inserting given elements in the same order 6, 5, 4, 1, 2, 3, 9, 8, 7, 10. Delete 4 after inserting all the element in the tree. Construct the tree after deletion operation is performed.

31. a) Find the shortest path using Dijkstra's algorithm — 12, 3, 5
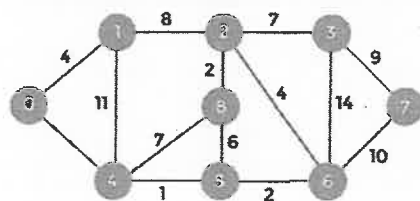
    (OR)

    b)Construct the minimum spanning tree using Prim's algorithm for the given graph.

32. a) An IT company uses a 3-digit employee ID as a primary key. The employee ID of 10 employees are 100,201,303,405,602,600,702,801,927,829. Consider a hash table of size 10 and insert the employee ID's in the hash table using division method. Apply linear probing method when 2 ID's map to the same location. — 12, 4, 6

    (OR)

    b) Discuss about Quadratic probing and Double Hashing with an example.

* * * * *

7. Identify the correct option for creating a node in linked list at first time   1   1   2
   (A) ptr = (struct node) malloc (sizeof(struct node *));
   (B) ptr = (struct node *)calloc(sizeof(struct node *));
   (C) ptr = (struct node *)malloc(sizeof(struct node));
   (D) ptr = (struct node *) calloc (size(struct node));

8. The matrix contains m rows and n columns. The matrix is called Sparse Matrix if   1   1   2
   (A) Total number of Zero elements > (m*n)/2
   (B) Total number of Zero elements = m + n
   (C) Total number of Zero elements = m/n
   (D) Total number of Zero elements = m-n

9. Which of the following is a practical example of a doubly linked list?   1   2   2
   (A) A browser cookie file.
   (B) A quest in a game that lets users retry stages.
   (C) A game in which the player runs forward.
   (D) A first-in-first out scheduling system.

10. A normal queue, if implemented using an array of size MAX_SIZE, gets full when?   1   1   2
    (A) Rear = MAX_SIZE – 1
    (B) Front = (rear + 1)mod MAX_SIZE
    (C) Front = rear + 1
    (D) Rear = front

11. A binary tree T has n leaf nodes. The number of nodes of degree 2 in T is   1   3   3
    (A) $\log_2 n$
    (B) n-1
    (C) n
    (D) 2^n

12. The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree?   1   3   4
    (A) 2
    (B) 3
    (C) 4
    (D) 7

13. In Binary tree traversing visiting the root node first, then left sub tree and right sub tree is called   1   2   4
    (A) Inorder
    (B) Preorder
    (C) Postorder
    (D) Levelorder

14. To perform level-order traversal on a binary tree, which of the following data structure will be required?   1   2   4
    (A) Hash table
    (B) Queue
    (C) Binary search tree
    (D) Stack

15. What is the concept behind Splay trees?   1   2   4
    (A) Easier to program
    (B) Space efficiency
    (C) Faster access to recently accessed objects
    (D) Quick searching

16. A person wants to visit some places. He starts from a vertex and then wants to visit every vertex till it finishes from one vertex, backtracks, and then explores another vertex from the same vertex. What algorithm he should use?   1   3   5
    (A) Depth First Search
    (B) Breadth-First Search
    (C) Prim's algorithm
    (D) Kruskal's Algorithm

17. Which of the following ways can be used to represent a graph?   1   3   5
    (A) Adjacency List
    (B) Incidence Matrix
    (C) No way to represent
    (D) Adjacency List and Adjacency Matrix

18. A rides sharing company uses which algorithm to find the optimal distance between the source and destination   1   3   5
    (A) Prims
    (B) Kruskals
    (C) Dijikstras
    (D) Floyd - Warshall

19. What is the hash function used in Quadratic probing?   1   1   6
    (A) H(x)= key mod table size
    (B) H(x)= (key+ F(i) mod table size, where F(i)=i
    (C) H(x)= (H(x)+ F(i)) mod table size, Where F(i)= i2
    (D) H(x)= (key+ F(i)) mod table size, where F(i)=Hash2(key)

20. Identify the size of the hash table for good distribution of the data in the hash table with less collision.   1   1   6
    (A) Odd number
    (B) Prime number
    (C) Random number
    (D) Even number

Part - B (5 × 4 Marks = 20 Marks)
Answer **any 5** Questions   **Marks BL CO**

21. Write the pseudo code and discuss about the time complexity of selection sort in the best case, worst case, and average case.   4   2   1

22. Calculate the total time required for the below program .   4   3   1
```
getMax(arr, n):
    index := 0
    max := arr[0]
    for i in range 1 to n - 1, do
        if arr[i] > max, then
            max := arr[i]
            index := i
        end if
    done
    return index
```

23. Discuss the insert a node at middle of doubly linked list with examples   4   3   2

24. Write an algorithm to transform infix expression to postfix expression   4   2   3

25. Construct the tree for the given infix expression ((a+((b/c)*d)-e).   4   4   3

26. Perform Splay(2) using Zig-Zig rotation   4   3   4

27. Construct Minimum Spanning tree using Kruskal's algorithm   4   3   5
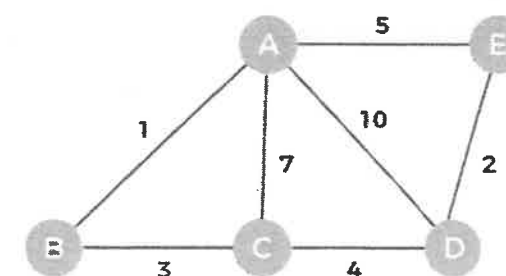
Part - C (5 × 12 Marks = 60 Marks)
Answer **All** Questions   **Marks BL CO**