Roll No. | | | | | | | | | | |

Total No. of Questions : 09

Total No. of Pages : 03

B.Tech.(CSE / AI & DS / AI & ML / Block Chain / Cyber Security / DS / Robotics & Artificial Intelligence / Internet of Things and Cyber Security including Block Chain Technology) (Sem.–3)

DATA STRUCTURE & ALGORITHMS

Subject Code : BTCS-301-18

M.Code : 76436

Date of Examination : 02-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly:**

   a) What is time and space complexity? Give suitable example of each.

   b) What is Big O notation? Give the Big O of inserting an element in a linear array.

   c) Given sorted array with 32 elements find the time complexity in worst case (in term of number of comparisons) for linear search, and binary search algorithm.

   d) Give any two applications of stack data structure.

   e) What is Big O for enqueue (), dequeue(), isempty(), isfull() operations for array implementation of circular queue?

   f) Give any two advantages of doubly linked list over single linked list.

   g) What is the advantage of using AVL tree over binary search tree?

   h) Give the worst case time complexity (as Big O) for bubble sort, heap sort, selection sort and merge sort.

   i) Give adjacency list and adjacency matrix representations of graph data structures.

   j) Define complete graph, strongly connected graph.

SECTION-B

2. Draw the binary search tree of the following 14,10,17,12, 11, 20, 12, 18, 25, 28, 22, 23 Delete the item say 20 from binary search tree and give the whole solution step by step diagrammatically.

3. Find the time complexity of the following code and mention it in Big O

```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < i; j++)
            count += 1;
    return count;
}
```

4. Write an algorithm to remove second last occurrence of an item from single linked list.

5. The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table (also show intermediate tables)?

6. Suppose you are given an implementation of a queue of integers. The operations that can be performed on the queue are :

   a) isEmpty (Q) — returns true if the queue is empty, false otherwise.

   b) delete (Q) — deletes the element at the front of the queue and returns its value.

   c) insert (Q, i) — inserts the integer i at the rear of the queue.

   Consider the following function :

```
void f(queue Q){
int i;
if (!isEmpty(Q)) {
    i = delete(Q);
    f(Q);
    insert(Q, i);
    }
}
```

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What operation is performed by the above function f()? Give step by step explanation with suitable example.

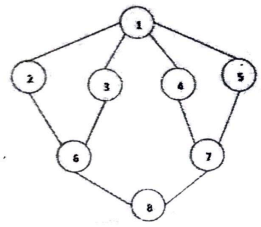
SECTION-C

7. Using the algorithms first convert infix to postfix and then evaluate postfix (give the step by step solution) for evaluating the following expression P.

P: (12/(7-3)) + (1 + 5)*2

8. Illustrate the execution of heap sort (in increasing order) in the sequence 3, 6, 17, 5, 1 1, 23, 38, 19, 26, 14.

9. What is DFS and BFS traversal of graph? Give the DFS and BFS traversal (starting with node 1) of graph. Show all intermediate steps.



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B.Tech. (AI & ML / AI & DS / CSE / DS / Internet of Things and Cyber Security including Block Chain Technology) (Sem.–3)

DATA STRUCTURE & ALGORITHMS

Subject Code : BTCS-301-18

M.Code : 76436

Date of Examination: 13-06-2024

Time : 3 Hrs.

Max. Marks : 60

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SECTION-A

1. **Write briefly :**

   a) Define Analysis of Algorithm.

   b) Write about binary search.

   c) Discuss applications of Linked Lists.

   d) Distinguish between stack and queue.

   e) Write applications of stack.

   f) What is garbage collection in Data Structure.

   g) Give the working of AVL tree.

   h) What is the main use of heap sort?

   i) Define a cycle in a graph.

   j) Write the importance of hashing.

SECTION-B

2. What are the types of queues? Explain the operation on queues?
3. Write the applications of Binary tree by taking examples.
4. Write an algorithm to convert infix expression to postfix expression.
5. Show the algorithm of Bubble sort.
6. What are the different ways of representing a graph?

SECTION-C

7. What is complexity? How it can be performed on different algorithms?
8. What is Circular Linked List? State the advantages and disadvantages of Circular Link List over Doubly Linked List and Singly Linked List.
9. How the search and traversing is done on Graphs? Illustrate by taking example.

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DATA STRUCTURE & ALGORITHMS

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DATA STRUCTURE & ALGORITHMS

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Total No. of Questions : 09 Total No. of Pages : 02

B.Tech.(CSE/AI&MAL/DS/ Internet of Things and Cyber Security including Blockchain Technology) (Sem.–3)

DATA STRUCTURE & ALGORITHMS

Subject Code : BTCS-301-18

M.Code : 76436

Date of Examination: 16-12-2023

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

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SECTION-A

1. **Write briefly :**

   a. What is the primary data structure used in linear search and what is its time complexity in the worst-case?

   b. What is the primary characteristic of a stack data structure?

   c. Define the term "asymptotic notation" and provide an example of its use in analyzing algorithms.

   d. What is the primary advantage of a doubly linked list over a singly linked list?

   e. What is the time complexity of the selection sort algorithm in the worst case?

   f. Differentiate between a queue and a priority queue.

   g. What is the primary purpose of an AVL tree in comparison to a standard binary search tree?

   h. In quicksort, what is the pivot element and how is it chosen?

   i. Define a directed graph and an undirected graph and explain the key difference between them.

   j. What is the purpose of a Depth-First Search (DFS) algorithm in graph traversal?

SECTION-B

2. Suppose you have two algorithms, A and B, for the same problem and their time complexities are $O(n^2)$ and $O(n \log n)$, respectively. Explain when you would prefer to use algorithm A over B and vice versa, considering real-world scenarios.

3. Compare and contrast linear queues, circular queues, and double-ended queues (dequeues). Provide specific use cases where each type of queue is most suitable.

4. Compare the structures and operations of a Binary Tree, Binary Search Tree (BST), and an AVL Tree. How does the balancing factor affect the performance of these structures? Provide real-world applications for each.

5. Compare and contrast the time complexity and efficiency of selection sort, bubble sort, and insertion sort. Under what circumstances would you choose one over the others?

6. Compare and contrast Depth-First Search (DFS) and Breadth-First Search (BFS) algorithms in terms of their traversal strategies. Provide examples of scenarios where one is more suitable than the other.

SECTION-C

7. Describe the fundamental operations of a stack, including "push," "pop," "peek," and "isEmpty." Explain their significance and how they are implemented in a stack data structure?

8. Describe the various types of linked lists, including singly linked lists, doubly linked lists, and circular linked lists. Explain their structures, advantages and common use cases. Provide examples of operations that can be performed on each type.

9. Explain the concept of hashing and its various applications in computer science. Describe the collision resolution techniques such as open addressing and chaining. Discuss the factors to consider when designing a good hash function and its impact on the performance of a hash table.

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Total No. of Questions : 18

Total No. of Pages : 02

B.Tech. (CSE) (2018 Batch) (Sem.–3)

DATA STRUCTURE & ALGORITHMS

Subject Code : BTCS-301-18

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3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Write briefly :

1. Write at least **three** differences between linear and binary search.
2. Write pseudo code to implement circular queue.
3. Stacks are used to implement recursion in programming languages. Explain why?
4. Evaluate below postfix expression.

   2 3 2 ^ ^ 8 2 / / 5 2 * 6 – +

5. Write pseudo code to find maximum element in a singly linked list. Consider node in linked list has 'data' field storing an integer.
6. Explain left and right rotations in an AVL tree.
7. Create the BST after inserting following elements in order in an empty BST.

   5, 6, 3, 2, 4, 7, 9, 1

8. What is in-place sorting?
9. What are stable sorting techniques?
10. What is Time complexity of quick sort in worst case? And why?

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SECTION-B

11. Solve the below recurrence relation using substitution method.

$$T(n) = \begin{cases} 2T\left(\frac{n}{2}\right) + C & ; \quad n > 1 \\ 1 & ; \quad n = 1 \end{cases}$$

12. Write pseudo code to implement queue using stack i.e. implement insert and delete operation of queue using push and pop.
13. A queue can be implemented using single linked list in two ways. One implementation has front at head and rear at tail of linked list. Other implementation has front at tail and rear at head of linked list. Which implementation among two is efficient and why?
14. Create hash table of length 13 for the following keys entered in the same order using below hash function. Linear probing is used to resolve collision.

    Keys : {4684, 4879, 5651, 1829, 1082, 7107, 1628, 2438, 3951, 4758, 6967, 4989}
    Hash function : (sum of all digits)% 13

15. Give the brief introduction to threaded Binary trees?

SECTION-C

16. Graph data structure can be very efficient in finding shortest path between two cities. Show with an example.
17. Explain :

    a) Difference between connected and unconnected graph.

    b) Discuss pros and cons of Adjacency matrix representation of a graph.

18. How a multidimensional array is represented in memory? Explain the program which reads two matrices?

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B.Tech. (CSE) (2018 Batch) (Sem.–3)

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SECTION-A

Write briefly :

1. What is the need of data structure?
2. Big O notation
3. Applications of stacks
4. Why binary search cannot be performed on linked list? Justify your answer.
5. B trees.
6. Hashing.
7. AVL tree.
8. Insertion sort
9. What are the objectives of sorting?
10. Write any two applications of graph.

SECTION-B

11. Explain the differences between linear and non-linear data structure. Give one example of each.
12. Explain the mechanisms of deleting an element from stack and queue by showing suitable example.
13. Write an algorithm for searching a node from a link list.
14. Discuss merge sort with suitable example.
15. Construct a binary search tree using the following numbers.

    49, 23, 37, 23, 66, 39, 59, 50

SECTION-C

16. Convert the given infix expression into postfix expression using stack and show the details of stack at each step of conversion.

    Expression : (a + b ^ c * d) * (e + f/g)

17. Discuss Heap sort with suitable example.
18. Write short note on the following :

    a) Quick sort

    b) Graph traversal algorithm

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