Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 18

B.Tech.(CSE) (2018 Batch) (Sem.–3)
DATA STRUCTURE & ALGORITHMS
Subject Code : BTCS-301-18
M.Code : 76436

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

Write briefly :

1. Write short note on space complexity.

2. What are the components of space occupied by a program?

3. Array and binary heap can be used to implement priority queue. Compare these methods with respect to time complexity for insertion and deletion.

4. Suggest an application of queue. Explain how queue is a better choice than array for that application.

5. Advantages of doubly linked list over singly linked list.

6. Differentiate between Binary Search Tree and AVL Tree.

7. What is a K-complete graph?

8. Differentiate between directed and undirected graph.

9. Discuss pros and cons of Adjacency list representation of a graph.

10. What is Time complexity for searching in a BST in worst case? And Why?

SECTION-B

11. Solve the below recurrence relation using substitution method.

$$T(n) = \begin{Bmatrix} T\left(\dfrac{n}{2}\right) + n^2 ; n > 1 \\ 1 \qquad ; n = 1 \end{Bmatrix}$$

12. Write pseudo code to implement bracket matching in an expression using stack. Consider expression can have '( )', '{ }' and '[ ]' brackets.

13. Explain with example insertion and deletion in a B+ tree.

14. Compare quick and merge sort for best, average and worst case scenarios with help of examples for each.

15. Construct MAX-HEAP for the following input by inserting elements one after another. Show heap after each iteration.

    20, 55, 16, 102, 13, 78, 94

SECTION-C

16. Convert the following infix expression to postfix. Illustrate each step clearly.

    a*(b ^ c (d/e – f) ^ g) + h

17. Write function to merge two sorted lists of length L1 and L2 respectively. Time complexity of function should not be greater than O (L1 + L2).

18. Write the algorithm for pre-order tree traversal. Also show the steps of this algorithm on an example set of numbers.

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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.

$$2\ 3\ 2\ \wedge\ \wedge\ 8\ 2\ /\ /\ 5\ 2\ *\ 6 - +$$

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?

SECTION-B

11. Solve the below recurrence relation using substitution method.

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

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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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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