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Sr. No. of Question Paper : 1263   F

Unique Paper Code   : 2342571201

Name of the Paper   : Data Structures

Name of the Course   : **B.Sc. (Programme) and B.A. (Programme)**

Year of Admission   : 2019 & onwards

Semester   : II

Duration : 3 Hours   Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Parts of the question must be answered together.

SECTION A

1. (a) Perform the insertion sort on the array {8,2,1,9,3}, show the steps after each iteration. Also, report the number of comparisons.

(4)

(b) Explain the properties of a binary heap. How is it different from a binary search tree.

(4)

(c) Differentiate between the following :

(4)

   (i) Arrays and Linked list

   (ii) Queue and Priority queue

(c) Consider a function f() to compute Fibonacci numbers as defined below :

(4)

   f()

   0 if n=0

   1 if n=1

   Fib(n)

   Fib(n-1)+Fib(n-2) if n>=2

   How many times will f() be called when n=4 ?

(d) Draw a binary search tree using the following key values; 16, 7, 23, 22, 14, 15

(4)

(e) What are the different operations that can be performed on a Dequeue. Explain using an example. (4)

(f) What are height-balanced trees? Explain using suitable example. (3)

(g) 'Stacks play a role in the implementation of recursion'. Justify the statement using a suitable example. (3)
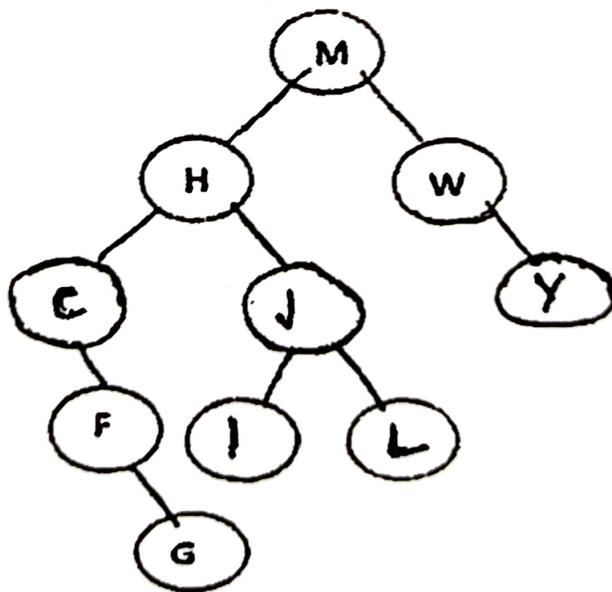
SECTION B

2. Consider the following Binary Search Tree. (15)

Show the status of the tree after each of the following operations :

(i) Draw the tree after insertion of node with value 'K'.

(ii) Delete node with value 'H' from the resultant tree.

(iii) Write the pr-order traversal of the resultant tree.

(iv) Is the resultant tree a height-balanced tree? Give justification for your answer.

(v) Finally, delete the node with value 'M' from the resultant tree.

3. (a) What is Binary Recursion? Write a program in C++ for computing Fibonacci numbers via Binary Recursion. (6)

(b) Write a program in C++ for performing a push operation on a stack using linked list. (5)

(c) Write a program in C++ to delete a given element from a doubly linked list. (4)

4. (a) Consider the following sequence of operations performed on an initially empty doubly linked list : (6)

InsertBeginning(10),

InsertBeginning(5),

InsertEnd(7),

InsertEnd(2),

DeleteBeginning(),

Deletenode(2)

Show the contents of the list, links between the nodes, head and tail after each operation.

(b) What is an abstract data type? Differentiate between Stack and Queue with the help of a suitable example. (4)

(c) Illustrate the operation of counting-sort on the array A = {6,0,2,0,1,3,4,6,1,3,2} (5)

5. (a) What is the advantage of using a circular linked list? Explain different operations performed on a circular linked list. (6)

(b) Give the asymptotic analysis for the Big-O notation using a suitable example. (5)
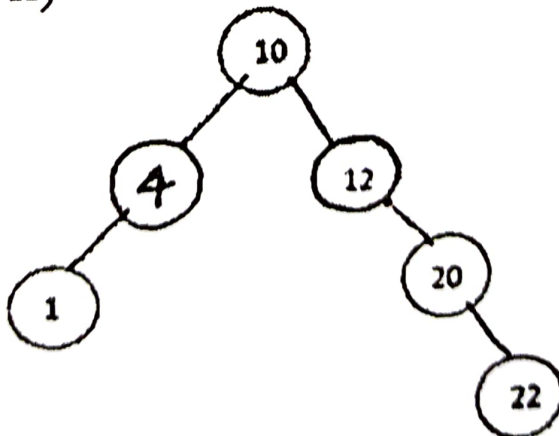
(c) Write any two real-life applications each of stack and queue.

(4)

6.   (a) For each of the following trees, specify whether it is a binary search tree or not. Give reasons for your answers.
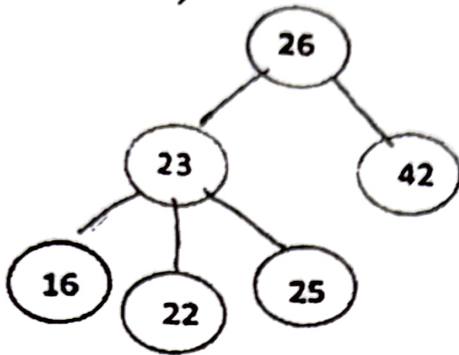
(6)

i)
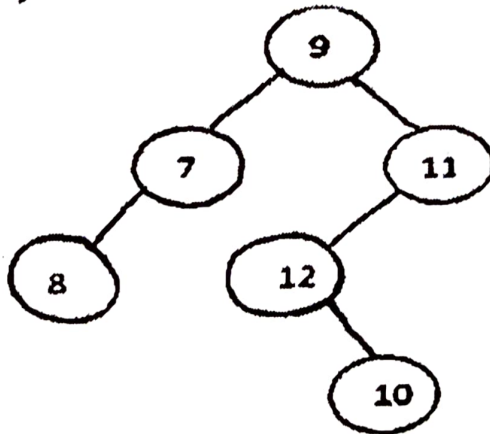
ii)

iii)

(b) Consider the following sequence of operations performed on a stack of size 5. Show the contents of the stack after each operation.   (5)

push (10),

push (5),

pop (),

push (2),

push (16),

push (12)

push (22)

push (6)

pop ()

(c) Write a C++ program to sum 'n' number of elements of an array using a recursive function.   (4)

7. (a) What do you understand by the Recursion-tree method for solving recurrences. Draw a Recursion tree for the recurrence $T(n) = T\left(\dfrac{n}{3}\right) + T\left(\dfrac{2n}{3}\right) + cn$. (6)

(b) Explain Master's theorem for solving recurrences giving a suitable example. (5)

(c) Write a C++ program to insert an element at the front of a singly linked list. (4)

Sr. No. of Question Paper : 1411   F

Unique Paper Code   : 2342571201

Name of the Paper   : Data Structures

Name of the Course   : **B.Sc. (Programme) and B.A. (Programme)**

Year of Admission   : 2019 & onwards

Semester   : II

Duration : 3 Hours   Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Parts of the question must be answered together.

P.T.O.

SECTION A

1. (a) How a binary heap is different from a binary search tree. Explain with a suitable example.

(4)

(b) What is the difference between Big-O and Big-Theta notation? Explain.

(4)

(c) When do we use Stack Data structure? Write a program in C++ for 'push' operation in array implementation of stack. Also discuss the stack overflow condition.

(4)

(d) Write a program in C++ to compute the sum of first n natural numbers using recursion.

(4)

(e) Create a binary search tree using the following key values;

12, 8, 23, 9, 14, 15

(4)
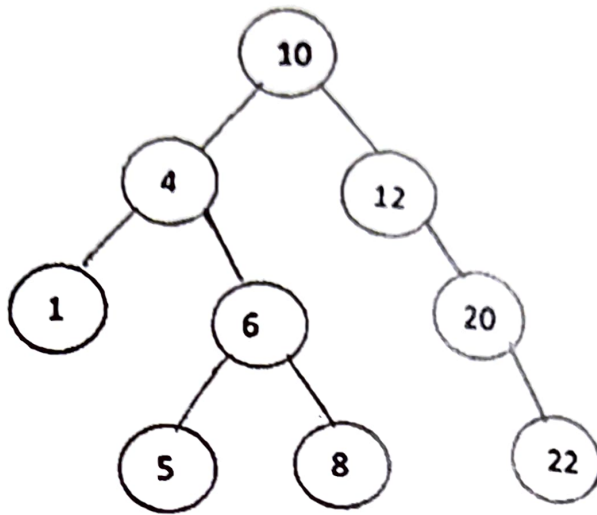
(f) Give the Breadth-First Traversal of the binary tree given below : (4)
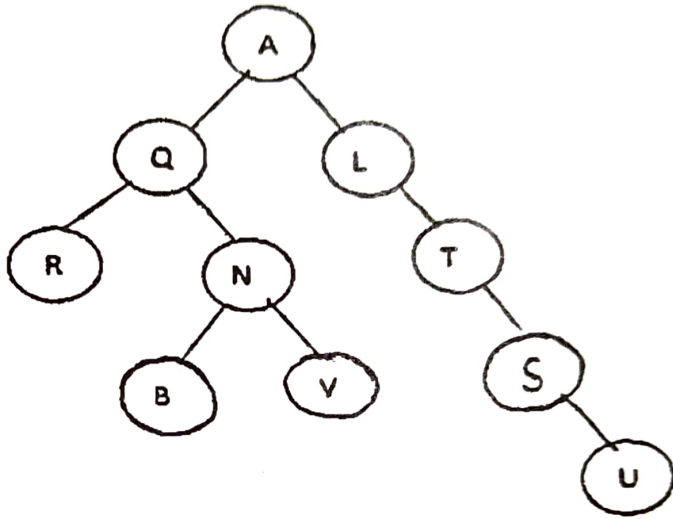
(g) What are height-balanced trees? Explain with the help of a suitable example. (3)

(h) Discuss the role of stacks in the implementation of recursion with the help of a suitable example. (3)

SECTION B

2. Consider the following Binary Search Tree. (15)

Show the status of the tree after each of the following operations :

(i) Draw the tree after insertion of node with value 11.

(ii) Delete node with value 10 from the resultant tree.

(iii) Write the pr-order traversal of the resultant tree.

(iv) Is the resultant tree a height-balanced tree? Give justification for your answer.

(v) Finally, delete the node with value 4 from the resultant tree.

3.   (a) Write a program in C++ to compute the factorial of a number with and without using recursion.   (6)

(b) Solve the recurrence $T(n) = 3T\left(\dfrac{n}{4}\right) + cn^2$ using Recursion-tree method.   (5)

(c) Write a program in C++ to insert an element at the front of a singly linked list.   (4)

4.   (a) Consider the following sequence of operations performed on an initially empty Deque :

         InsertFront(10),

         InsertFront(5),

         EraseFront(),

         InsertBack(7),

         Front(),

         EraseBack()

Show the contents of the deque and output after each operation.   (6)

(b) Write a program in C++ for computing Fibonacci numbers via Binary Recursion.   (5)

(c) Illustrate the operation of counting-sort on the array A = {5,0,2,0,1,3,4,5,1,3,3}   (4)

5. (a) Consider the functions given below, sort the functions in increasing order of asymptotic (big-O) complexity :   (6)

$$f_1(n) = n^{0.999999}\log n$$

$$f_2(n) = 10000000\ n$$

$$f_3(n) = 1.000001^n$$

$$f_4(n) = 2^{1000000n}$$

$$f_5(n) = n\sqrt{n}$$

$$f_6(n) = n(n-1)/2$$

(b) Write a program in C++ for performing an enqueue operation for an array-based queue implementation.   (5)

(c) Write a program in C++ to search for an element in a doubly linked list and delete it if found.

(4)

6. (a) Explain how Master's theorem can be used for solving recurrences giving suitable example.

(6)

(b) Compare and contrast priority queue and dequeue. Also, give one real-life application of priority queue.

(5)

(c) Write a program in C++ to reverse a given array using recursion.

(4)

7. (a) What is a circular linked list? How a circular linked list is different from a doubly linked list. Discuss different operations performed on a circular linked list.

(6)

(b) Perform the insertion sort on the array {7,1,10,6,3}, show the steps after each iteration. Also, report the number of comparisons.

(5)

P.T.O.

(c) Explain any two Abstract Data Types. (4)

Your Roll No...............

Sr. No. of Question Paper : 1431   **F**

Unique Paper Code   : 2342571201

Name of the Paper   : Data Structure

Name of the Course   : **B.A. (Programme)**

Semester   : II

Duration : 3 Hours   Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **Section A** is compulsory.

3. Answer any **four** questions from **Section B**.

4. **All** parts of Question must be attempted together.

P.T.O.

SECTION A

1. (a) Explain Static and Dynamic data structure with the help of a suitable example. (4)

   (b) Write C++ code for basic operations on Stack using array. (4)

   (c) Differentiate between Binary tree and Binary heap. (4)

   (d) Mention advantages of using Tree data structure. (3)

   (f) What are Height-balanced trees? Explain with the help of a suitable example. (3)

   (g) Mention any three applications of Stack. (3)

(h) Apply insertion sort on given array arr = {12, 4, 34, 6, 8}. Mention the resultant array after the 2nd iteration. (3)

(i) Differentiate between Queue and Priority Queue.

(3)

(j) What will be the output after performing following operations on an empty stack
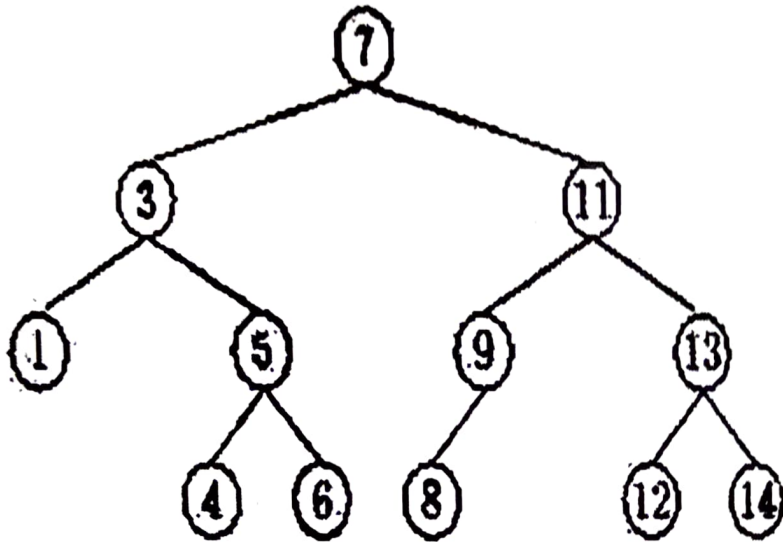
Push(4), Push(5), Pop(), pop()Push(5), Push(6), Pop() pop() (3)

SECTION B

2. Consider the following Binary Search Tree (BST).

(15)

Show the status of BST after each of the following

operations :–

(i) Draw updated tree after inserting a node with

value 2 in the BST.

(ii) Delete node 11 from the updated BST.

(iii) Write post-order traversal of the resultant

BST.

(iv) Add a node with value 10 to the tree constructed in step (iii) and draw the final tree.

(v) Write BFS traversal of the Final tree.

3. (a) Differentiate between Array and Linked list with suitable example. (6)

(b) Draw a binary tree whose in-order and preorder traversals are given below :–

In-order : FBADCE

Preorder : ABFCDE (5)

(c) Write a program in C++ to perform insertion and deletion at the end of a singly linked list.

(4)

4.   (a) Differentiate between Deque and Queue with the help of a suitable example.   (6)

    (b) Explain Master's theorem for solving recurrences with the help of a suitable example.   (5)

    (c) Explain Stack overflow and Stack underflow condition.   (4)

5.   (a) Write a program in C++ to implement Queue using Array.   (6)

    (b) List any two advantage and two disadvantage of using recursion   (5)

    (c) Write a C++ program to find n Factorial using recursive function.   (4)

6.   (a) Differentiate between (with example) :   (6)

      (i) BSF and DFS Traversal

      (ii) BST and height-balanced tree

   (b) Write C++ code to implement doubly linked list and discuss basic operations to be performed on doubly linked list.   (5)

   (c) Explain base case and recursive case in recursion with a suitable example.   (4)

7.   (a) Illustrate and perform count sort on the array {4,7,2,0,7,5}   (6)

   (b) How many iterations are required to sort an array {6,12,5,8,4,7} using insertion sort?   (5)

(c) Explain Big - analysis with an example.

(4)