Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (W), Mumbai : 400058, India

(Autonomous College of Affiliated to University of Mumbai)

End Semester Examination

December 2023

Maxi Marks : 100 | Duration : 3 hours
Class : S.E | Semester : III
Course code: CS202 | Branch :CE/ CSE-DS/CSE-AIML
Name of the course : Data Structures

Q No		Max Mks	CO
Q1a	i) Imagine we have 2 empty stacks of integers, s1 and s2. Draw a picture of each stack after the following operations: *pushStack (s1, 3)* *pushStack (s1, 5)* *pushStack (s1, 7)* *pushStack (s1, 9)* *pushStack (s1, 11)* *pushStack (s1, 13)* *loop not emptyStack (s1)* *→ x = popStack(s1)* *→ pushStack(s2, x)* *end loop* ii) Evaluate the following prefix expressions 1) + - * 2 3 4 5 2) - * 2 + 3 4 5 3) / + 3 3 - + 4 7 * + 1 2 3 4) + * 4 - 2 * + * 6 3 4 2 1 **OR** ii) Write the following expressions in the postfix and prefix form 1) (A + B) * C - D * F + C 2) (A - 2 * (B + C) - D * E) * F	02 04	CO1
Q1b	i) Explain the Josephus problem with an example. ii) Imagine the contents of queue Q1 and queue Q2 as shown below. What would be the contents of Q3 after the following code is executed? The queue contents are shown **front(left) to rear (right).** Q1: 42 30 41 31 19 20 25 14 10 11 12 15 Q2: 4 5 4 10 13	03 03	CO1

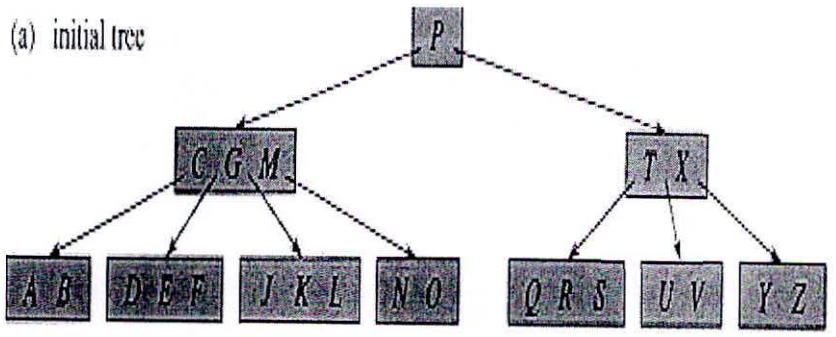
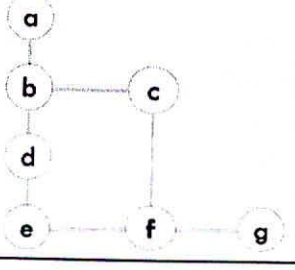
```
Q3 = createQueue
count = 0
loop (not empty Q1 and not empty Q2)
   count = count + 1
   x = dequeue(Q1)
   y = dequeue(Q2)
   if (y equals count)
   → enqueue(Q3, x)
   end if
end loop
```

OR

What would be the contents of queue Q1 and queue Q2 after the following code is executed and the following data are entered? The data are: 5, 7, 12, 4, 0, 4, 6

```
1    Q1 = createQueue
2    Q2 = createQueue
3    loop (not end of file)
3a      read number
3b      enqueue(Q1, number)
3c      enqueue(Q2, number)
3d      loop (not empty Q1)
           x = dequeue(Q1)
           enqueue(Q2, x)
3e      end loop
4    end loop
```

Q1c	i) Write a function in C/C++/Java/Python to implement univariate polynomial **Multiplication** using linked lists. The function should accept 2 Linked Lists, where each linked list represents a univariate polynomial. It should perform multiplication on the 2 lists, and return the resultant univariate polynomial, represented as a list, as output. Please note: All univariate polynomials should be represented in the decreasing order of its exponents.	10	CO1
	ii) What is a Generalized linked list? Give the structural representation of a *GLL Node*. **OR** Give the structural representation of a *Polynomial GLL Node* and elaborate on its various components.	03	
	iii) Represent the following list using GLL with a shared sublist. Draw a supportive diagram. Give sample declaration in C language of generalized linked list given below. **L = (((1,2,3), (1,2,3), (2,3), 6), 4, 5, ((2,3), 6))**	05	

Q2a	i) Construct binary tree from the given traversals. Inorder Traversal : { 4, 2, 1, 7, 5, 8, 3, 6 } Postorder Traversal : { 4, 2, 7, 8, 5, 6, 3, 1 } Show all the construction steps. ii) Write the function insert(t,v) to insert value v in a binary search tree t. Construct binary search tree for the following values: 52, 37, 74, 91, 65, 44, 16, 83, 28, 21.	4 6	CO2
Q2b	i) State the Properties of B tree. Show the B-tree of order- 6 that results when inserting the following 14 keys: **R, Y, F, X, A, M, C, D, E, T, H, V, L, W, G** (in that order). You need to only draw the trees just before and after each split. **OR** Consider the given initial B Tree of order 6 and Delete the given 5 keys: ***F, M,* G, *T,* and S** in the given order. Show the Updated B tree after every deletion and explain the applicable deletion case in detail for every key.  ii) What is the use of AVL tree? Construct an AVL tree for the given data where nodes are inserted in the following order. Explain all the applicable rotations during insertion. 27, 25, 23, 29, 35, 33, 34. After the construction of an AVL tree, perform the following delete operations in the given sequence: i. Delete node 25 ii. Delete node 33	10 10	CO2
Q3	i. Write an algorithm to traverse a graph using Breadth First Search ii. Represent the given graph using the adjacency matrix iii. For the given graph in what order will the nodes be visited using both Breadth-first Search and Depth First Search Algorithm (start node=b)? Show the status of the required data structure used. **Policy:** Visit the node in Alphabetically increasing order.  	03 01 06	CO2

Q4a	i) Construct Min-Heap for the given data in A. A = {15, 13, 9, 5, 12, 8, 7, 4, 0, 6, 2, 1} Show all the intermediate steps and final heap structure after all data insertion. ii) Apply Extract_Min( ) procedure on the above updated heap to extract the 4th largest key from the heap. Show the intermediate steps of each extraction.	08 04	CO3
Q4b	What is a Fibonacci Heap? Explain delete a min key operation with the help of an example.	08	CO3
Q.5	i) Given the values {2341, 4234, 2839, 430, 22, 397, 3920}, a hash table of size 7, and hash function **h(x) = x mod 7**, show the resulting tables after inserting the values in the given order with each of these collision strategies. 1- Quadratic Probing 2- Double Hashing with second hash function as **h'(x) = (2x - 1) mod 7** ii) Explain the effect of Primary and Secondary Clustering in Hashing.	08 02	CO4

----------All the Best----------