CS214 Fianl 472

Q1- Choose the correct answer for the following questions: [10 marks]

1- In an array-based implementation of a circular queue of size MAX, which of the following is a correct condition to check if the queue is completely full?

a) (rear == front)

b) (rear + 1 == MAX) && (front == NULL)

c) (rear + 1 == front) || ((rear == MAX - 1) && (front == 0))

d) (rear == MAX - 1)

2- What is the maximum number of nodes in a complete binary tree of height 3?

a) 16 b) 15 c) 8 d) None of these

3- In a standard array-based implementation of a linear queue, after deleting the last remaining element from the queue, what are the updated values of front and rear?

a) rear = 0, front = -1

b) rear = -1, front = -1

c) rear = -1, front = 0

d) rear = 0, front = 0

4- In a standard array-based implementation of a stack, after retrieving an element from the stack, what is the correct next step?

a) top = 0 b) top-- c) top++ d) arr[top] = num

5- A Binary Search Tree (BST) is significantly more efficient for searching for values than a standard binary tree because:

a) It always guarantees a perfectly balanced structure automatically.

b) It is arranged in a particular sorted way.

c) It eliminates approximately half of the remaining elements at each step of the search.

d) It uses less memory to store each element.

6- When deleting a node with two children from a Binary Search Tree, we copy the data of its inorder successor. Which of the following statements is true regarding the inorder successor node?

a) It is always a leaf node.

b) It is always either a leaf node, or a node that has no left child.

c) It can be a parent of a left child.

d) It is always either a leaf node, or a node that has no right child.

7- If a circular queue of size 5 has three values currently stored from queue[2] to queue[4], if we want to enqueue a new value, which of the following is the correct representation of its place?

a) queue[0] b) queue[1] c) queue[5] d) queue[2]

8- A doubly linked list has 4 nodes connected in the following order:

node1 <-> node2 <-> node3 <-> node4

If a pointer named current is pointing to node2, what is the node that is accessed by the expression current->prev->next?

a) node1 b) node2 c) node3 d) node4

9- In binary tree, every node have at most two children.

a) True b) False

10- In an AVL tree, which of the following choices correctly states the balance factors of the node and its child that cause an LR imbalance?

a) The balance factor of the node is +2 and its child is +1

b) The balance factor of the node is -2 and its child is +1

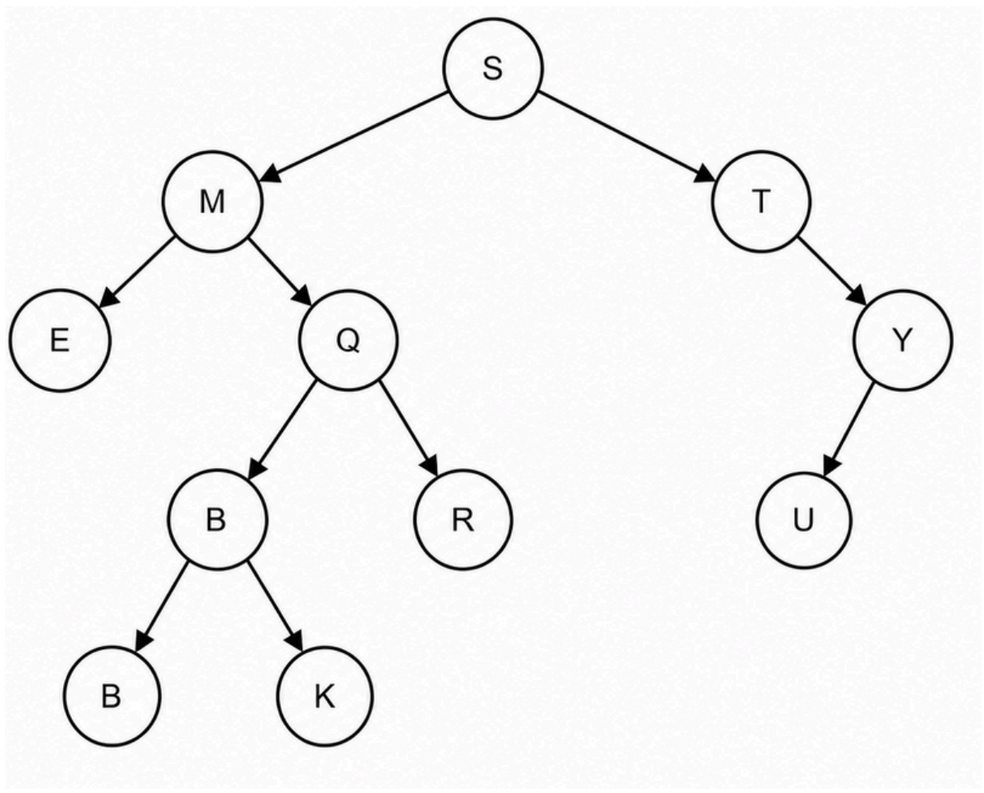
c) The balance factor of the node is -2 and its child is -1

d) The balance factor of the node is +2 and its child is -1

Q2- Construct an AVL tree when inserting the following values: [10 marks]

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Q3- Given the binary tree shown in the figure below, perform a complete tree traversal and list the exact sequence of nodes visited for each of the following methods: [6 marks]



Inorder:

Preorder:

Postorder:

Q4- Consider a stack that is initially empty. Execute the following operations in order. For each step, show the resulting contents of the stack. [4 marks]

Operation	[Bottom ... Top]
push(20)	
pop()	
push(30)	
push(40)	
pop()	
pop()	

Q5- Assume a circular queue of size 5 is implemented using an array. Track the queue's state and provide the updated array index values for both rear and front. **[6 marks]**

Operation	rear	front
Initial	-1	-1
Enqueue(20)		
Enqueue(30)		
Enqueue(40)		
Enqueue(50)		
Enqueue(60)		
Dequeue()		
Enqueue(67)		
Enqueue(70)		

Q6- Write a destructor of doubly linked list to delete all nodes. **[4 marks]**

Q7- Write a function to search for a specific value in the binary search tree and return true if the value is found, false otherwise. [5 marks]

Q8- Write a function to insert a value into an array-based circular queue of size MAX. Your code must handle all conditions. [5 marks]

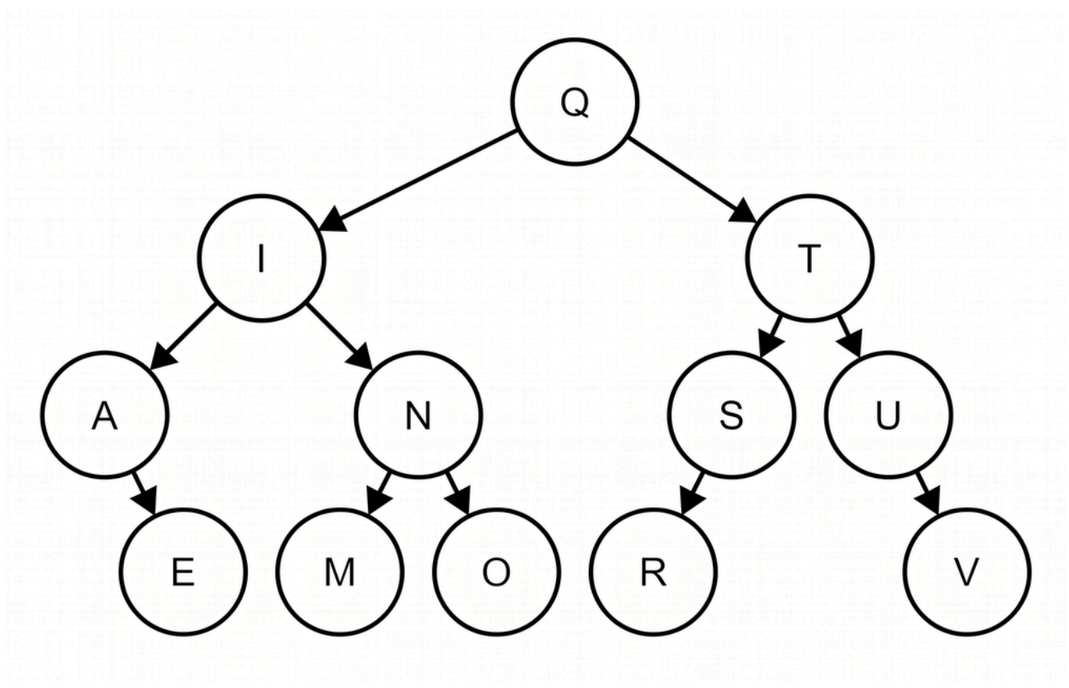
Answers are on the next page

Answers

Question 1 answer:

1	**c**	**6**	**b**
2	**b**	**7**	**a**
3	**b**	**8**	**b**
4	**b**	**9**	**a**
5	**c**	**10**	**d**

Question 2 answer:



Question 3 answer:

Inorder	**E M B B K Q R S T U Y**
Preorder	**S M E Q B B K R T Y U**
Postorder	**E B K B R Q M U Y T S**

Question 4 answer:

Operation	[Bottom ... Top]
push(20)	[20]
pop()	[ ]
push(30)	[30]
push(40)	[30, 40]
pop()	[30]
pop()	[ ]

Question 5 answer:

Operation	rear	front
Initial	-1	-1
Enqueue(20)	0	0
Enqueue(30)	1	0
Enqueue(40)	2	0
Enqueue(50)	3	0
Enqueue(60)	4	0
Dequeue()	4	1
Enqueue(67)	0	1
Enqueue(70)	0	1

Queue is full, an overflow occurs, no changes

Question 6 answer:

```
~dlinkedlist()
{
    dnode *temp;
    while(head != NULL)
    {
        temp = head;
        head = head->next;
        delete temp;
    }
}
```

Question 7 answer:

```
bool search(btreenode *sr, int num)
{
    if(sr != NULL)
    {
        if(num == sr->data)
            return true;
        else if(num < sr->data)
            return search(sr->leftchild, num);
        else
            return search(sr->rightchild, num);
    }
    return false;
}
```

Question 8 answer:

```
void insert(int num)
{
    if((rear + 1 == front) || ((rear == MAX -1) && (front == 0)))
    {
        cout << "Queue is full" << endl;
        return;
    }

    if(rear == MAX - 1)
        rear = 0;
    else
        rear++;

    arr[rear] = num;

    if(front == - 1)
        front = 0;
}
```