COMSATS University Islamabad
Abbottabad Campus
Department of Computer Science
Midterm Exam - FALL 2024

8/11/24

Class: BCS 4A+BSE 4C
Subject: Data Structure and Algorithms
Total Time Allowed: 90 min
Name:_____

Date: 12-11-2024
Instructor: Humaira Jabeen
Max Marks: 50
Registration #_____

CLO-1(C3)(Question-1)

a) **Solve the following questions and explain the answer.** **(2x5=10)**

i. When a new node is added in the middle of singly linked list then how many nodes need to be moved.

ii. Suppose currentNode refers to a node in a linked list (using the Node class with member variables called data and nextNode). What boolean expression will be true when cursor refers to the tail node of the list.

iii. The list abstract data type (ADT) is used to work with ordered or unordered sequence of items such as numbers or strings. What of the following implementation of list ADT is best to answer questions such as "What is the item at position n?"

iv. What would be returned by the following recursive function after we call test (0, 3)

```
int test (int a, int b)
{
  if (a==b) return (1);
  else if (a>b) return(0);
  else return (a+test(a+1, b));
}
```

v. How many maximum nodes you can add when you implement stack with linked list?

b) Generate Postfix Notation from the following Infix Notation, use stack for the simulation: **(10)**

(((A+B)/D) ^ ((E-F)*G))

c) **Following is the code to implement circular linked list. What would be the output of following program?** **(10)**

```
class Node {
  int data;
  Node next;
  Node(int data) {
    this.data = data;
    this.next = null;
  }
}
```

```
public class CircularLinkedList {
    Node head;

    // Function to add a new node to the circular
linked list
    public void addToEnd(int data) {
        Node newNode = new Node(data);
        if (head == null) {
            head = newNode;
            head.next = head; // Point to itself to
make it circular
        } else {
            Node temp = head;
            while (temp.next != head) {
                temp = temp.next;
            }
            temp.next = newNode;
            newNode.next = head; // Complete the
circular link
        }
    }
```

```
    public int CNodes() {
        if (head == null) {
            return 0; // No nodes in the list
        }
        int c = 1;
        Node current = head;
        while (current.next != head) {
            c++;
            current = current.next;
        }
        return c;
    }
    public static void main(String[] args) {
        CircularLinkedList cll = new
CircularLinkedList();
        cll.addToEnd(10);
        cll.addToEnd(20);
        cll.addToEnd(30);
        cll.addToEnd(40);

        System.out.println("Result is " +
cll.countNodes());
    }}
```

CLO-2(C3)(Question-2)

a) Given a stack *s* and a queue *q*, show the contents of each after the indicated operations. The starting contents of *s* and *q* are shown. If an operation would result in an error, write "error" and assume the contents of *s* and *q* do not change. If there is no change otherwise, leave the cell blank or use ditto marks (").Stack is empty and there are 2 elements in queue 2 and 7. **(10)**

Operation	Contents of stacks Top bottom	Contents of queue q front rear
Start	*empty*	2, 4
s.pop()		
s.push(3)		
q.add(5)		
s.push(q.peek())		
q.add(s.peek())		
q.add(s.pop())		
s.push(s.pop())		
q.add(q.remove())		

b)**Suppose a queue is maintained by a circular array QUEUE with N = 14 memory cells. Find the number of elements in QUEUE if** **(10)**

(i) Front = 11, Rear = 4.

(ii) Front =6, Rear = 7and then two elements are deleted.

(Explain your answer in diagram of queue and show status of queue in each case)