Kingdom of Saudi Arabia
Ministry of Education
Qassim University
College of Computer
Department of Computer Science

المملكة العربية السعودية
وزارة التعليم
جامعة القصيم
كلية الحاسب
قسم علوم الحاسب

Course Code: "CS 214 Data Structures"
Semester: 432

Mark_____/40

Final exam
Duration: 2 hours
Date: 9 / 6 / 2022

Student Name: Solutions	**Student ID:**	**S.No.:**

Exam starts here

Q-1: Write a C/C++ program that check weather the string is palindrome or not

Step 1. Create stack structure implementation of linked list

Step 2. Create queue structure implementation of linked list

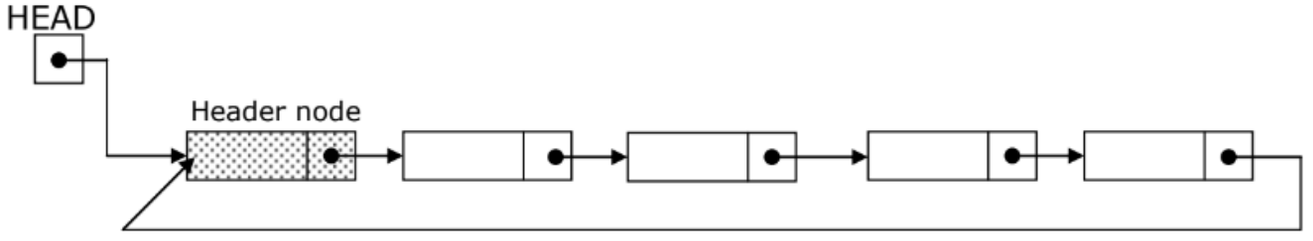
Step 3. In main function read the string from the user then check it using only **(stack /queue operations)**

Solution: https://www.onlinegdb.com/1QpN0-IR2

Palindrome word is a word that you can read it from either left to right and vice versa

Examples of palindrome: ***MADAM*** ***LEVEL***

Q-2-A: Assume that we have the following structure of a circular header linked list:



Write a function which calculates the sum of odd and even nodes then take the difference then insert it in the end of the list.

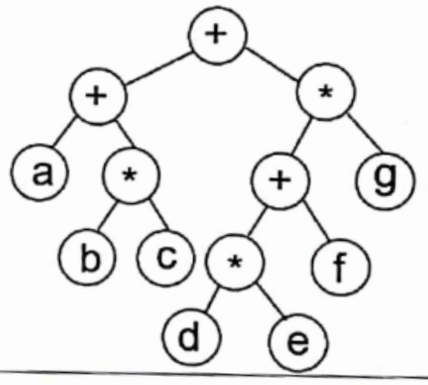
Solution: https://www.onlinegdb.com/luqssBVnG

Q-2-B: Write a function to calculate the average value in the binary search tree

Solution: https://www.onlinegdb.com/SPVCDDv77

Q-3-A: Write the output for the givin code and tree.

```
struct  treeNode
   {  char    symbol;
      struct  treeNode *Left;
      struct  treeNode  *Right;
   };
```




```
void DO (treeNode  *T)
{
   if( T != NULL )
   {
     if(T->Left != NULL && T->Right != NULL) cout<<"(";
     DO (T->Left);
     cout << T->symbol <<" ";
     DO (T->Right);
     if(T->Left != NULL && T->Right != NULL)  cout<<")";
   }
}
```

OUTPUT:

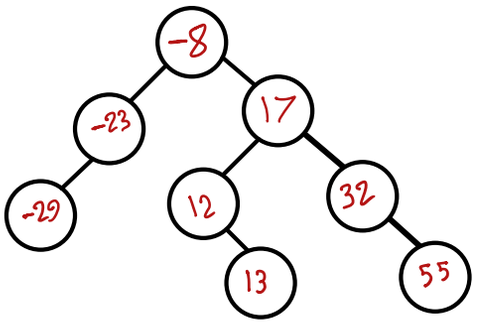
Solution: (5) ((a+(b*c))+(((d*e)+f)*g))

Q-3-B: insert the givin values in BST : -8 17 -23 32 -29 55 12 13

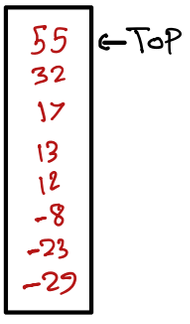
a) Draw the BST
b) Insert the values traversly in-order into stack
c) Pop the stack and write the output

Solution: (5)

a)



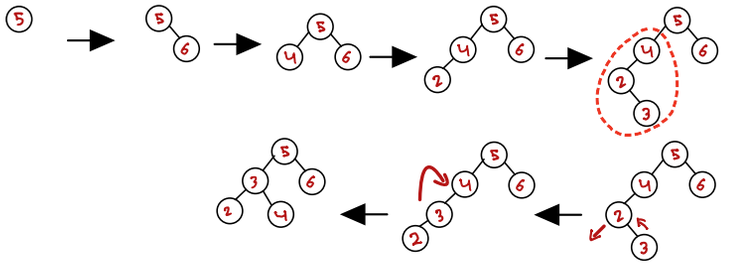
b)



C) 55, 32, 17, 13, 12, -8, -23, -29

Q-4-A: Draw the AVL tree with this values and show the steps 5 6 4 2 3.

Solution:



Q-A-B:**What is the difference between linear and non linear data structures**

(you can use examples)

Solution: (5)

LINEAR DATA STRUCTURES	NON-LINEAR DATA STRUCTURES
Linear Data structures are used to represent **sequential** data.	Non-linear data structures are used to represent **hierarchical** data.
Linear data structures are **easy** to implement	These data structures are **difficult** to implement.
Implementation: Linear data structures are implemented using array and linked lists	**Implementation:** Non-linear data structures are mostly implemented using linked lists.
e.g: The basic linear data structures are list, **stack and queue**.	**e.g:** The basic non-linear data structures are **trees and graphs**.
For the implementation of linear data structures, we don't need **non-linear** data structures.	For the implementation of non-linear data structures, we need **linear** data structures.
USE: These are mostly used in application software development.	**USE:** These are used for the development of game theory, artificial intelligence, image processing

Q-4-C: Describe how the deletion in BST happen.

Solution: (5)

Deletion in BST: Let x be a value to be deleted from the BST and let **N** denote the node containing the value x. Deletion of an element in a BST again uses the BST property in a critical way. When we delete the node **N** containing x, it would create a "gap" that should be filled by a suitable existing node of the BST. There are two possible candidate nodes that can fill this gap, in a way that the BST property is not violated: (1). Node containing highest valued element among all descendants of left child of **N**. (2). Node containing the lowest valued element among all the descendants of the right child of **N**.
Following figure on next page illustrates several scenarios for deletion in BSTs.

Good luck
Dr. Mohammed Mahdi &
Faten Alrusayni