Data Structures and Algorithms

Lab Assignment 2

Assignment Questions

A. Stack Using Array

1. Write a program to **create** a stack of integers using an array.
2. Implement the **push()** operation to add an element to the stack.
3. Implement the **pop()** operation to remove the top element from the stack.
4. Implement the **peek()** operation to view the top element without removing it.
5. Write **isEmpty()** and **isFull()** functions for the stack.
6. Display all elements of the stack from top to bottom.
7. Using the array-based stack, write a program to **reverse an array** of integers.

B. Stack Using Linked List

1. Implement a stack using a **singly linked list**.
2. Implement **push()** to insert a new node at the top of the stack.
3. Implement **pop()** to delete the top node from the stack.
4. Implement **peek()** to view the top node without deleting it.
5. Write a function **isEmpty()** for the linked list stack.
6. Display the contents of the linked list stack.
7. Modify the linked list stack to store **floating-point** or **string** values.
8. Using the linked list stack, write a program to **check if a string is a palindrome**.

C. Implement Expression Conversion

1. **Infix to Postfix Conversion:** Input: `a+b*(c^d-e)^(f+g*h)-i`
2. **Prefix to Infix Conversion:** Input: `*-A/BC-/AKL`
3. **Infix to Postfix Conversion:** Input: `(A + (B * C - D) ^ E) / (F * (G + H))`
4. **Evaluations of a Arithmetic Expression:**
   - **Infix Expression:**
     `((A ^ B) * (C - D / E) + F) / (G * (H ^ I - J))`
   - **Prefix Expression:**
     `/+AB-/CDEFG-^HIJG`
   - **Postfix Expression:**
     `AB^CDE/F-+GH^IJ-*/`
   - **Sample Values:**
     $A = 2$, $B = 3$, $C = 10$, $D = 8$, $E = 4$, $F = 5$, $G = 2$, $H = 2$, $I = 2$, $J = 1$

Write programs to evaluate the above expression in each form (infix, prefix, and postfix); display the result using the sample values.