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**Department of (Computer Science)**

**Pak-Austria Fachhochschule: Institute of Applied Sciences and Technology, Haripur, Pakistan**

**COMP-112L Data Structure** **& Algorithm Lab**

**Lab Journal**

**Class: BS Computer Science**

**Name: Ahmed Raza**

**Registration No.: B20F0436CS031**

**Semester: 4th**

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**Submitted to: Engr. Rafi-Ullah**

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**Instructor Signature**

**Lab No. 11**

**Open Ended Lab**

**Objectives:**

In this lab we will be discussing about Stack by using Arrays in detail. This is one of the most important concepts in Data Structure C++ language. Stack is a linear data structure & an Abstract Data Type (ADT) that used in most programming languages. It is named stack as it behaves like a real-world stack. Stack allows operations at one end only.

**Tools/Software Required:**

* All the tasks are implemented on DEV C++.

**Introduction:**

**Stack:**

Stack is a linear data structure & an Abstract Data Type (ADT) that used in most programming languages. It is named stack as it behaves like a real-world stack. Stack allows operations at one end only.This feature makes it LIFO data structure. LIFO stands for **Last-in-first-out**.

**Lab Tasks:**

**Task 1:**

Perform a task that’ll do Arithmetic operations by using Stack with array in Postfix method.

**Code:**

**#include <iostream>**

**#include <string.h>**

**#include <stdlib.h>**

**using namespace std;**

**class Stack**

**{**

**public:**

**int top;**

**int capacity;**

**int\* array;**

**};**

**class Stack\* createStack( int capacity)**

**{**

**class Stack\* stack = new Stack;**

**if (!stack)**

**return NULL;**

**stack->top = -1;**

**stack->capacity = capacity;**

**stack->array = (int\*) malloc(stack->capacity \* sizeof(int));**

**if (!stack->array)**

**return NULL;**

**return stack;**

**}**

**int isEmpty(class Stack\* stack)**

**{**

**return stack->top == -1 ;**

**}**

**char peek(class Stack\* stack)**

**{**

**return stack->array[stack->top];**

**}**

**char pop(class Stack\* stack)**

**{**

**if (!isEmpty(stack))**

**return stack->array[stack->top--] ;**

**return '$';**

**}**

**void push(class Stack\* stack, char op)**

**{**

**stack->array[++(stack->top)] = op;**

**}**

**int evaluatePostfix(char\* exp)**

**{**

**class Stack\* stack = createStack(strlen(exp));**

**int i;**

**if (!stack)**

**return -1;**

**for (i = 0; exp[i]; ++i)**

**{**

**if (isdigit(exp[i]))**

**push(stack, exp[i]- '0');**

**else**

**{**

**int val1 = pop(stack);**

**int val2 = pop(stack);**

**switch (exp[i])**

**{**

**case '+':**

**cout<<"Sum of value(1) "<<val1<<" and value(2) "<<val2<<" is: "<<val2+val1<<endl;**

**push(stack, val2 + val1);**

**break;**

**case '-':**

**cout<<"Subtraction of value(1) "<<val1<<" and value(2) "<<val2<<" is: "<<val2-val1<<endl;**

**push(stack, val2 - val1);**

**break;**

**case '\*':**

**cout<<"Multiplication of value(1) "<<val1<<" and value(2) "<<val2<<" is: "<<val2\*val1<<endl;**

**push(stack, val2 \* val1);**

**break;**

**case '/':**

**cout<<"Division of value(1) "<<val1<<" and value(2) "<<val2<<" is: "<<val2/val1<<endl;**

**push(stack, val2/val1);**

**break;**

**}**

**}**

**}**

**return pop(stack);**

**}**

**int main()**

**{**

**char exp[10];**

**cout<<"Enter any numbers with operation/s to perform: \n";**

**for(int i=0; i<10; i++)**

**cin>>exp[i];**

**cout<<"Input is: (";**

**for(int i=0; i<10; i++)**

**cout<<exp[i]<<",";**

**cout<<")"<<endl;**

**cout<<"postfix evaluation: "<< evaluatePostfix(exp);**

**return 0;**

**}**

**Output:**

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**Results & Observations:**

In this Lab I've learned about the concept of Stack with arrays to perform arithmetic operations like +, -, \*, / etc. Further I understand Postfix method that’s perform the required operation to the last two numbers that was entered in the stack.