COLLEGE OF COMPUTING AND INFORMATICS

CSEB3213/CSEB324/CSNB344 DATA STRUCTURES AND ALGORITHMS

SEM 1 2024/2025

LAB 5: STACKS

Objectives

Introduction on Stacks concept and operations in both STL and Linked List implementations using C++ programming language.

Instruction

1. This is an individual lab exercise.
2. You are compulsory to complete **ALL QUESTIONS.**
3. Compile and submit your complete **cpp** programs via Brighten.
4. Submission deadline: End of lab session.
5. Do attach this code segment to your file:

```
/*Subject code : CSEB3213 Data Structure & Algorithms
  Section      : 02B
  Student name : XXX
  Student ID no: XXX
  Question no  : XXX */
```

LEVEL: EASY

Question 1 (12 marks)

Referring to sample of program below:

a. Complete the **main()**. This function should be able to invoke all functions in the program. (2 marks)

b. Write a function named **grading()**. This function should be able to display: (6 marks)

- status of each mark in stack (pass or fail , with a passing mark set at 50.0.
- total pass status.
- total fail status.

c. Write a function named **pop()**. This function should be able to remove all marks in stack. (4 marks)

Sample of Program

```
#include<iostream>

using namespace std;
struct Data{
    float mark;
    Data *next;
};

void push(/*suitable parameter*/){
    Data *n = new Data;
    n->mark = mark;
    n->next = NULL;

    /*insertion process*/
}

//Question 1(b)

//Question 1(c)

int main() {
    Data *head = NULL; int size; float mark;

    cout<<"Enter total data to insert: ";
    cin>> size;
    for(int i = 1; i<=size; i++){
        cout<<"Enter mark : ";
        cin>>mark;
        //Question 1(a)
    }
    //Question 1(a)
    //Question 1(a)

    if(head == NULL)
        cout<<"[Result] All marks have been deleted."<<endl;

    cout<<"\nEnd of program";
    return 0;
}
```

Sample of Output

```
Enter total data to insert: 6
Enter mark : 50.8
Enter mark : 78.4
Enter mark : 48.6
Enter mark : 90.2
Enter mark : 66.4
Enter mark : 42.4

:: Grading ::
Mark 1 : 42.4 (Fail)
Mark 2 : 66.4 (Pass)
Mark 3 : 90.2 (Pass)
Mark 4 : 48.6 (Fail)
Mark 5 : 78.4 (Pass)
Mark 6 : 50.8 (Pass)
Total Pass : 4 students.
Total Fail : 2 students.

Removing all marks...
[Result] All marks have been deleted.

End of program
```

Question 2 (8 marks)

Referring to your solution in **Question 1**, convert the program to **STL Stack** implementation.

LEVEL: MODERATE

Question 3 (10 marks)

Source: Lab Test Semester 1 2020/2021 (Set 2)

CASE STUDY

One of the well-known stack applications is converting decimal number to binary. Algorithm of the conversion is as follows:

```
BEGIN
    SET number, digit
    READ number
    WHILE (number > 0)
    digit = number modulo 2
    DISPLAY digit
    number = number / 2
    ENDWHILE
END
```

Issue:

The problem with above algorithm is that it will print the binary number backwards, e.g.: 19 become 11001 instead of 10011.

Source: Data Structures by Gilbert and Forouzan

Referring to the above case study, using **Stack STL** implementation with appropriate functions, develop a complete C++ program to remedy the issue. Refer to sample output below.

SAMPLE OUTPUT 1

```
:: Decimal-Binary Converter ::
Enter a decimal number [larger than 0] : 0
Enter a decimal number [larger than 0] : -26
Enter a decimal number [larger than 0] : 26
Decimal number : 26
Binary number : 11010
Thank you.
```

LEVEL: MODERATE (Self-Lab Revision Exercise)

Question 4

Referring to the same case study and procedures, solve the issue using **Stack Linked List** implementation.