COSC230 Assignment 3

This assignment consolidates material from *Practicals 4* and *5* on "Stacks, Queues, and Recursion". Please work through these practicals before attempting this assignment. Please submit all of your assignment files through `Turing` (see the link Assignment Submission via `Turing`). Before you submit your assignment please check your code compiles on `Turing` and does what you expect it to.

Question 1 (a warm-up): [*30 marks*]

Use the following function interface:

```
void reverse_stack(stack<int>& S, stack<int>& S1, stack<int>& S2),
```

and write a `C++` function that reverses the order of elements on stack S using two temporary stacks S1 and S2: only modify the stacks using the operations listed in the stack interface (i.e., do not use the assignment operator). Is it possible to do this with only one temporary stack? A good format for testing your function is the following:

```
std::stack<int> S, S1, S2;

S.push(1), S.push(2), S.push(3);

cout << "The top element of S is: " << S.top() << endl;

reverse_stack(S, S1, S2);

cout << "The top element of S is now: " << S.top() << endl;
```

Submit the code for this function in a file called `assignment3_functions.cc`.

Question 2: *[40 marks]*

(a) Use the following function interface:

```
void print_stack_rec(stack<int>& S),
```

and write a simple recursive function (i.e., no loops are to be used) that prints the contents of stack `S` to the console and then restores the stack back to its original state.

(b) Use the following function interface:

```
void print_stack_iter(stack<int>& S),
```

and write an iterative function (i.e., using `while` loops and a temporary stack) that prints the contents of stack `S` to the console and then restores the stack back to its original state.

A simple way to test the functions in (a) and (b) is to call each function twice and check the printed output is the same each time. This confirms that the stack is restored correctly. Submit the code for these functions in the file `assignment3_functions.cc`, as for Question 1.

Question 3: *[30 marks]*

Use the following function interface:

```
double sum(int n),
```

to write a recursive function (i.e., no loops are to be used) to add the first n terms of the series:

$$1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} + ...$$

and return the value of that sum. Make sure to test that your function gives the correct output, and submit the code in the file `assignment3_functions.cc`