Homework #3

Data Structure (501324-3)

2022-2023 1st Trimester

Due: Saturday October 29, 2022, 11:59 pm via Blackboard

Required:

- Answer all the following questions.
- Implement and show the output of each linked list question.
- In each coding exercise, add a comment // your name // your id.
- NO homework will be accepted without this comment.
- Put everything in one PDF file and upload it.
- NO LATE homework or excuses will be accepted. I gave you enough time to work on this homework.

Question 1:

Write a C++ code to insert the following numbers into a linked list:
20, 9, 18, 8, 99

(a) Write a user-defined function that prints this list.
(b) Write a function that calculates and prints the average of these numbers.
(c) Delete the node that carries the data 8 and display the linked list.

Question 2:

Write a C++ code that create a linked list with 12 random numbers between 1 and 100.

(a) Write a user-defined function that prints this list.

(b) Write a function that takes a number from the user and searches that entered number in linked list

- if you find the number in the list, move the node containing that number to the end of the linked list and print the new list.
- otherwise, tell the user that the number was not found.

Question 3:

Suppose we have a stack **S** and a queue **Q**. What are final values in the stack **S** and in the **Q** after the following operations? Show contents of both **S** and **Q** at each step indicated by the line.

```
Stack S;
Queue Q;
int x, y;
S.push(10);
S.push(20);
S.push(S.pop()+S.pop());
Q.enqueue(10);
Q.enqueue(20);
Q.enqueue(S.pop());
S.push(Q.dequeue()+Q.dequeue());
```

Question 4:
Suppose we have an integer-valued stack S and a queue Q. Draw the contents of both S and Q at each step indicated by the line. Be sure to identify which end is the top of S and the front of Q.

```
Stack S;
Queue Q;
S.push(3);
S.push(2);
S.push(1);
Q.enqueue(3);
Q.enqueue(2);
Q.enqueue(1);
int x = S.pop();
Q.enqueue(x);
x = Q.dequeue();
Q.enqueue(Q.dequeue());
S.push(Q.peek());
// peek() function reads the front of a queue without deleting it
```

Question 5:
What will be the content of queues Q1, Q2, and Stack S, after the following code segment?

```
while(!Q1.isEmpty())
{
x = Q1.Dequeue();
if (x == 1)
{
        z = 0;
        while(!S.isEmpty())
        {
        y = S.pop();
        z = z + y;
        }
                        Q2.Enqueue(z);
}
Else
        S.push(x);
}


Stack S;
        Queue Q1, Q2;
        int x, y, z;

        Q1.Enqueue(9);
        Q1.Enqueue(6);
        Q1.Enqueue(9);
        Q1.Enqueue(1);
        Q1.Enqueue(7);
        Q1.Enqueue(5);
        Q1.Enqueue(1);
        Q1.Enqueue(2);
        Q1.Enqueue(8);
```

Question 6:
Assume that you have a stack S, a queue Q, and the standard stack - queue operations: push, pop, enqueue and dequeue. Assume that print is a function that prints the value of its argument. Execute, in top-to-bottom order, the operations below and answer the following questions.

```
push(S, ‘T’);
enqueue(Q, ‘I’);
push(S,dequeue(Q));
enqueue(Q, ‘I’);
enqueue(Q, ‘G’);
print(dequeue(Q));
enqueue(Q, T);
push(S, ‘I’);
push(S, dequeue(Q));
print(pop(S));
enqueue(Q, pop(S));
push(S, ‘O’);
print(pop(S));
enqueue(Q, ‘O’);
print(dequeue(Q));
enqueue(Q, pop(S));
push(S, dequeue(Q));
print(pop(S));
print(pop(S));
```

Question 7:

(i) Use stack to evaluate the following infix expressions

(3 * 4 – (2 + 5)) * 4 / 2

(ii) Use stack to evaluate the following postfix expressions

8 2 3 ^ / 2 3 * + 5 1 * -

(iii) Convert the following infix expression into postfix expression using stack.

(3 * 4 – (2 + 5)) * 4 / 2