NYU, Tandon School of Engineering
Extended Bridge to CS — Spring 2024

Exam 3

MCQ and Short Answer

Question 1

When using an STL List, which of the following data types is useful in accessing the elements in the list?

- ListIntItr
- STL<int>::List
- List<int>::iterator*
- List<int>::iterator

Question 2

Which STL data structure might be useful in keeping a set of integers in sorted order while removing duplicates?

- Set
- Vector
- Queue
- List

Question 3

A function which is fully implemented in both the base class and the derived class is known as a:

- Abstract class
- Overloaded function
- Pure virtual function
- Overridden function
- Derived function

Question 4

A derived class wanted to call the base class version of itself. Provide the code to replace the comment below to ensure the base version of the function is called while passing two times the value of x.

```
class Base{
    int val;
protected:
    void func(int x){ val = x; }
};

class Derived: public Base{
public:
    void func(int x){ /* Your code HERE! */ }
};
```

Question 5

Convert the following infix expression to postfix form:

$$(A + (B - C) * D/E) + F$$

Question 6

Evaluate the following postfix expression to its value:

$$3\ 4\ *\ 2\ 5\ *\ +$$

Long Answer

Question 7

Given an STL stack, provide a templated function which will determine the maximum value in the stack (the elements can be compared using operator<). Your function must take a stack by reference and the values on the stack must be the same at the beginning and the end.

Question 8

You are given the root node of a binary tree and asked to determine in Theta (N) time if this tree is a binary search tree. Explain how you would do this in English, do not provide code.

Question 9

Given a pointer to the first node of a linked list, you are asked to determine if any loops exist in the list (i.e., a ”next” pointer which points to a node accessible to the ”left” of the node). Explain, in English, do not provide code, how you would do this. In your answer, please provide your runtime for this solution.

Question 10

A file on the hard drive ("input.txt" it exists, you do not need to test for it) contains integers, one per line. We would like to find out how many duplicates exist in this file. Provide a function which will accept the input file stream and will return the number of unique elements in the file.

For example, the result would be 5 (17, 21, 3, 47, and 52 are unique), if the file contained the following:

```
17
17
21
3
47
47
47
52
```

Question 11

We would like to design a few classes to handle vehicles in a parking garage. The garage will handle Bicycles, Sedans, and SUVs, each at a different cost. Bicycle parking costs $120/month, Sedans cost $650/month and SUVs cost $850/month (yes, these are NYC prices!). You're asked to implement the classes with the following restrictions:

1. The Garage class can only store a single vector.
2. You must provide a function to add a vehicle to the garage.
3. You must provide a function in each class to return the cost, a double, to park that item. (i.e. `Sedan.cost()` would return 650).
4. You must provide a function in the Garage class to return the total income of the garage (i.e. `Garage.income()` would return 650 if only a sedan were parked in the garage).

Below is a sample `main()` function for how the classes might be used.

```
int main() {
    Sedan s1;
    SUV s2;
    SUV s3;
    Bicycle b1;
    Bicycle b2;
    Garage parking;
    parking.addVehicle(s1);  // adds 650 (total is 650)
    parking.addVehicle(s2);  // adds 850 (total is 1500)
    parking.addVehicle(s3);  // adds 850 (total is 2350)
    parking.addVehicle(b1);  // adds 120 (total is 2470)
    parking.addVehicle(b2);  // adds 120 (total is 2590)
    cout << parking.income() << endl;  // prints 2590
}
```