CECS 282 - Lab 3

Reading

Reading from *C++ How to Program*:

1. Important: Chapter 8.1, 8.2, 8.3, 8.4
2. Skim Chapter 6.10
3. Chapter 6.13
4. Chapter 15.1, 15.2 (focus **only** on **vector**), 15.3 “Introduction to Iterators”
5. Chapter 15.5 (again, **only** vectors)

Assignment

1. What is the output of the following C++ code fragment? Trace the code’s operation to support your answer: keep track of each variable’s current value, and indicate what actual values the pointers point to.

```
#include <iostream>
using namespace std;

double Blah(int *p) {
   *p = *p + 5;
   double local = *p / 2;
   return local;
}

int main() {
   int x = 10;
   int *y = &x;
   double z = Blah(y);
   cout << x << endl << z;
}
```

2. Write a C++ function `SolveQuadratic` which solves a quadratic equation of the form $ax^2 + bx + c = 0$ when given the coefficients a, b, and c. Your function should take three double parameters for the three coefficients, plus two double **pointer** parameters that you will use to save the two solutions to the equation. You will return an integer indicating the number of real solutions to the equation.

   Your function should not do any input or output; it should only calculate and set the solution variables, and return the numbe of solutions.

   Example usage:

```
double xSolution1, xSolution2;
double a, b, c;
// suppose a, b, and c are given values from the user
int numberOfSolutions = SolveQuadratic(a, b, c, &xSolution1, &xSolution2);
```

   Test your code to make sure it works in the following scenarios:

a	b	c	`numberOfSolutions`	`xSolution1`	`xSolution2`	Explaination
1	2	1	1	-1	0	For $x^2 + 2x + 1 = 0$, the only solution is $x = -1$
1	0	1	0	0	0	No real solution to $x^2 + 1 = 0$
1	-3	-4	2	4	-1	For $x^2 - 3x - 4 = 0$, the solutions are $x = 4$ and $x = -1$

3. In the following code fragment:

```
string a = “hello”;
string b = a;
string *c = &a;
string &d = *c;
string e = *c;
```

   How many instances of the `string` type exist in memory? Draw a picture of automatic storage for these variables.

4. Ada is writing several functions that each accept a `string` parameter. For each function description, decide if the function should accept its parameter as a `string`, a `string*`, a `string&`, or a `const string&`:

   (a) In `FuncA`, Ada will read individual characters from the string to make a computation. She will not mutate the string.

   (b) In `FuncB`, Ada will mutate the string parameter, but doesn't want the original string passed to the function to mutate.

   (c) In `FuncC`, Ada will mutate the string parameter, and the string cannot be “null”/`nullptr`.

   (d) In `FuncD`, Ada does not want to duplicate the string passed to the function, and is prepared to handle a null value as well.

5. Given the following C++ program:

```
#include <vector>
#include <iostream>
using namespace std;

void FA(vector<int> &p1) {
    // see part (a)
    p1.pop_back();
    p1.push_back(0);
}
void FB(vector<int> p2) {
    FA(p2);
}
int main() {
    int x = 0;
    vector<int> v = {1, 2, 3, 4};
    FB(v);
    cout << v.size() << "␣" << v[3];
}
```

   (a) By the time the comment is reached at *run time*, how many actual `vector` objects exist in automatic storage? Identify them.

   (b) At what point in the program will the parameter `p2` be destroyed and removed from memory? Be specific.

   (c) What is the printed output of this program?

How to Get Credit

Show me your answers to each question.