CSC 150 MIDTERM

NAME:_____

1. Part A (40%)

1. Define/ explain the concept of a *function* in a C++ program.

2. Explain the difference between a *function definition* and a *function call*.

3. Explain the concepts of *formal parameters* and *actual parameters* of a function. Explain the purpose of each of these two concepts, and point out how a person can tell a formal parameter from an actual parameter.

4. Explain what it means for a function to be *recursive*. As part of your explanation, discuss the concept of a *base case* for a recursive function.

5. Explain the concept of *scope* for an identifier used in a program.

6. Why did Professor Muganda say in class that *global variables are evil* and should be avoided whenever possible? Be sure to address in your answer whatever evil effects global variables can have on a program.

2. Part B (60%)

1. Write a function that takes a vector of elements of type `int` as parameter and returns the number of integers stored in the vector that are even. For example, if the contents of the vector are [23, 5, 89, 5], the function will return 0, but if the contents of the vector are [45, 3, 5, 8, 12, 6, 17], the function will return 3.

```
int evenCount(vector<int> vec)
```

2. Write a function that takes a vector of elements of type `string` and returns a vector of type `int` that consists of the lengths of the strings in the first vector.

The prototype of the function should be this

```
vector<int>  string_lengths(vector<string> svec)
```

If you are not sure how to write the function, you should at least show how to create the vector of integer lengths by using the vector of strings.

3. Suppose that in your program, there is an integer variable

```
int number;
```

that holds a positive integer value.

Write code that prints out all the decimal digits of the number, in any order. For example, if the value in the number is 78023, then the code you write should print out 7, 8, 0, 2, 3 in any order.

4. Write a recursive function

```
int factorial(int number}
```

that returns the factorial of non-negative number.

5. Consider the sequence $s(n)$ of integers

n	0	1	2	3	4	5	6	7	...
$s(n)$	1	1	1	2	3	7	23	164	...

In this sequence, the first 3 terms are all 1, but every other term is the product of the two terms immediately preceding, plus the term just before that. For example, the term $s(5) = 7 = 3 \times 2 + 1$.

Write a function `int s(int n)` that takes an integer $n \geq 0$ as parameter and returns the nth term of the sequence.

6. Write a function

```
bool all_same_chars(string str)
```

that takes a string as parameter, and returns true if the string does not have two characters that differ from each other, but returns false if the string has at least two different characters. For example:
`all_same_chars("aaa")` is true
`all_same_chars("a")` is true
`all_same_chars("axa")` is false.

Also, `all_same_chars("")` is true for the empty string.

HINT: you can treat strings of length less or equal to 1 as a special case.