COP3331 Lab 5

Submission Instructions:

1. Create a folder named Lab5_lastNamefirstInitial (e.g. Lab5_NealT).
2. In your folder, place a **PDF** file containing your answers to questions with a ♢.
3. Copy your directories containing your programs for questions with a ♠ into the folder; **these directories should only contain files needed to run your program, which may include one or more of the following file types: .cpp, .h., and .txt**. Do NOT include the full project (e.g., solution file). Test your program on CIRCE before submitting by compiling and running with `g++`. Your file containing main() should **always** be named main.cpp.
4. Ensure that all programs have block comments at the very beginning (starting at the first line) in the file containing main() with your name and the program's description. **The block comment's format should be identical to what's provided in Figure 2-1.**
5. Use single-line comments to describe your code's functionality as needed.
6. Do not submit anything for questions with a ♣.
7. Zip the folder and submit it via Canvas.

♢ = 5 points each, ♠ = 15 points each

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1. ♣ Read *Chapter 11: How to work with STL algorithms.*
2. ♣ Read *Chapter 12: How to work with built-in arrays and C strings.*
3. ♣ Read *Chapter 13: How to work with exceptions.*
4. ♢ A function template
   a. allows the function to accept different data types
   b. allows the function to work with a varying number of arguments
   c. allows the function to return different data types
   d. all of the above

5. ♢ Given this vector:

```
vector<int> scores { 92, 87, 98, 76, 85 };
```

what is the value of the variable named i after the following code is executed?

```
auto max = max_element(scores.begin(), scores.end());
auto i = max - scores.begin();
```

a. 98
b. 2
c. 6
d. An iterator that points to the element with the largest value

6. ♢ Given this function:

```
int sum_nums(int total, pair<int, int> p) {
    return total + (p.first * p.second);
}
```

what is the value of the variable named sum after the following code is executed?

```
multimap<int, int> nums{ {2, 10}, {3, 20}, {3, 30}, {4, 40} };
int sum = accumulate(nums.begin(), nums.end(), 0, sum_nums);
```

a. 100
b. 200
c. 330
d. 1200

7. ♢ If you omit the size declarator when you define an array, you must
a. set the size before you use the array
b. use an initialization list so the compiler can infer the size
c. assign a value to each element of the array that you want to create
d. copy elements from another array

8. ♢ To copy an array, you should
   a. use the assignment operator
   b. store the second array in a reference variable and then use the assignment operator to copy to first array to the second array
   c. use a loop to copy the elements from one array to the other
   d. get a pointer to each element in the array and then dereference the pointer and assign the value to an element in the other array

9. ♢ Which of the following statements defines a C string?

```
a. char message[] = {'W', 'e', 'l', 'c', 'o', 'm', 'e', '!'};
b. char message[] = {'W', 'e', 'l', 'c', 'o', 'm', 'e', '!', '\0'};
c. char message[] = 'Welcome!';
d. char message[] = 'Welcome!\0';
```

10. ♢ What happens when the following code is executed?

```
void function2() {
    throw runtime_error("An error occurred in function2!");
}

void function1() {
    try {
        function2();
        throw runtime_error("An error occurred in function1!");
    }
    catch(const exception& e) {
        cout << e.what() << "\n\n";
    }
}

int main() {
    try {
        function1();
    }
    catch(const exception& e) {
        cout << e.what() << "\n\n";
    }
}
```

a. An exception is thrown by function1() and caught by the main() function.
b. An exception is thrown by function1() but isn't caught so the program crashes.
c. An exception is thrown by function2() and caught by function1().
d. An exception is thrown by function2() and caught by the main() function.

11. ♠ **Lab5_Q11: Binary Search (STL version)**
Create a program that uses an STL algorithm to perform a binary search that checks whether a number is in a sequence of sorted numbers. Save in folder `lab5-q11`.
Console

```
Binary Search program

Enter 0 to exit

Random numbers:  [13, 16, 18, 29, 32, 71, 71, 77, 78, 90]

Enter a number from 1 to 100: 1
1 is NOT in random numbers.

Enter a number from 1 to 100: 32
32 is in random numbers.

Enter a number from 1 to 100: 100
100 is NOT in random numbers.

Enter a number from 1 to 100: 0
Bye!
```

Specifications

- The program should begin by generating a list of 10 random integers from 1 to 100 (both inclusive).
- The program should allow the user to enter a number from 1 to 100. Then, it should display whether that number is or isn't in the list of random numbers. Use data validation to ensure the number is within the right range.
- The program should use an STL algorithm to sort the numbers.
- The program should use an STL binary search algorithm to search the list of random numbers.