CSci 1113
Final

Name: ____________________________________________

Student ID: ________________________________

Lab Section (circle one): W5:45, Th8:00, Th11:15, Th2:30, Th5:45

Instructions: Please pick and answer any 10 of the 12 problems for a total of 100 points. If you answer more than 10 problems, only the first 10 will be graded. The time limit is 120 minutes. Please write your answers in the space provided. The exam is open book and notes. You may use electronic devices to ONLY look at either an e-book version or electronic notes. You may not use the internet, compiler or any other outside resources. (If you are typing on your keyboard/input device for anything other than ctrl-F to find words in the e-book or notes, this is probably not acceptable.)
Problem (1) [10 points] Write (in C++) a getSlope() member function for the class below (i.e. the function should be inside the class). A slope can be found by this formula: \( \frac{y_2 - y_1}{x_2 - x_1} \). Simply write the definition of getSlope(), you do not need to declare it.

```cpp
class Problem1 {
private:
    double xStart;
    double xEnd;
    double yStart;
    double yEnd;
public:
    Problem1();
};
```

Problem (2) [10 points] Write (in C++) a useful non-default constructor for the following class (just the actual function definition, you do not need to declare it):

```cpp
class Problem2 {
private:
    char symbol;
    string name;
    double speed;
public:
    Problem2();
};
```
**Problem (3)** [10 points] Suppose a class “Problem3” is defined as below, along with the code segment inside the default constructor. Write an appropriate deconstructor in C++.

```cpp
class Problem3 {
private:
    int* x;
public:
    Problem3();
};
```

// somewhere inside the constructor
    x = new int[10];

**Problem (4)** [10 points] What is the output of the following segment of code. What part (if any) should you use *delete* on from this segment? Explain your reasoning.

```cpp
int a = 5;
int b = 2;

int* x = &a;
int* y = &b;

y = x;
*y = *x * *y;

cout << a << "   " << b << endl;
cout << *x << "   " << *y << endl;
```
Problem (5) [10 points] Write (in C++) an overload function for the “>>” operator (i.e. for cin) for the following “Point” class to give values to all variables inside the class (i.e. member variables). This time you do need to declare the function in the class (you can draw an arrow from some text into the class given below) along with the definition.

class Point {
private:
    double x;
    double y;
public:
    Point();
    void setX(double newx);
    void setY(double newy);
    double getX(); // returns x value
    double getY(); // returns y value
};

Problem (6) [10 points] Write (in C++) a midPoint() function that takes as input two Point variables (as defined in problem 5). This function should correctly find and return the midpoint of the two Points passed in as input (the formula for this case is: \(x_{\text{midpoint}} = \frac{x_1 + x_2}{2}, y_{\text{midpoint}} = \frac{y_1 + y_2}{2}\)). An example code of its use is given below:

    Point p1;
    Point p2;
    // magically initialize p1 and p2 to something
    Point mid = midPoint(p1, p2);
Problem (7) [10 points] Write (in C++) a evenArray() function, which returns a dynamically created array of even numbers (starting from 0 going up) of the size specified by the input. For example, for the code segment below the array length should be 10 (containing numbers 0 through 18).

```cpp
int* evenNumbers = evenArray(10);
```

Problem (8) [10 points] Find 3 possible places for errors in the following code. Assume this is all the code except for namespaces and includes. Explain specifically what causes each error and whether it is a syntax or logic error:

```cpp
class Problem8 {
private:
    double y;
    getY();
};

double getY()
{
    return y;
}

int main()
{
    Problem8 x;
    cout << getY();
    return 0;
}
```
Problem (9) [10 points] Write (in C++) a recursive function eachDigit() that will cout each digit of the input integer on a separate line.

```cpp
int main()
{
    eachDigit(456);
    // above should cout (note it is reversed):
    // 6
    // 5
    // 4
}
```

Problem (10) [10 points] Write a segment of code in C++ (i.e. pretend you are writing somewhere in main()) that creates the following 10 by 10 array. The first row and column (i.e. top row and left column) should be 1. Every other cell in the array should be the sum of the cell to the left plus the cell above itself.
Problem (11) [10 points] Write (in C++) a findMax() function that takes in three integers as inputs. This function must have a void return type and set the third input integer to the maximum of the first two input integers. An example use is below:

```cpp
int a = 2;
int b = 10;
int x;

findMax(a, b, x);
cout << x << endl; // should show 10
```
Problem (12) [10 points] Write (in C++) a single if-statement that is true on the set of integers shown. A “...” signifies that the pattern continues in the specified direction (i.e. a “...” on the left indicates the pattern continues for smaller numbers). An example is provided below.

int i: 0, 1, 2, 3, 4, ...

Answer:
if(i >= 0)
  or
if(i > -1)

(a) int i: ... -10, 0, 10, 20, 30, 40, ...

(b) int i: ... -2, 2, 4, 6, 8, 12, 14, 16, 18, 22, ...
(look carefully)

(c) int i: 0, 1, 2, 3, 4, 6, 7, 8, 9, 10
(look carefully)

(d) int i: ... -8, -6, -4, -2, 12, 14, 16, 18, 20, ...
(you might want parenthesis for this)

(e) int i: 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 15
(parenthesis might be necessary here too)