CSci 1113
Final

Name: ─────────────────────────────────

Student ID: ──────────────────────────

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] What is the output of this code? You must show work for full credit.

```
int** z = new int*;
*z = new int;
int x = **z;
int* y = *z;
*y = 4;
y = &x;
**z = 2;
cout << x << " " << *y << " " << **z << endl;
```

Problem (2) [10 points] Suppose there exists a function randArr() that returns an array of 10 random double numbers. First, write (in C++) code that creates and stores 100 arrays from the randArray() function into a single variable. Then, write a second part of code that ensures there is no memory leak (assume this code is run after you are done with the variable).

Problem (3) [10 points] Write an appropriate operator=() overload for the following "Problem3" class. Write both the declaration and definition for this function.

```
class Problem3{
public:
    int* dyn_var;
    char* dyn_arr;
    Problem3(int n);
};

Problem3::Problem3(int n)
{
    dyn_var = new int;
    *dyn_var = n;
    dyn_arr = new char[*dyn_var];
}
```

Problem (4) [10 points] What is the output of this code? Write a sentence or two saying why you think your answer is the correct output.

```
class Problem4{
public:
    int a;
    int b;
    int c;
    Problem4(int a, int b, int c);
};

Problem4::Problem4(int a, int b, int c)
{
    a=a;
    Problem4 :: b=b;
    c=this->c;
}

Problem4 magic(Problem4 x)
{
    int temp;
    temp = x.a;
    x.a = x.b;
    x.b = x.c;
    x.c = temp;

    return x;
}

int main()
{
    Problem4 x = Problem4(3,4,7);
    magic(x);
    cout << x.a << " " << x.b << " " << x.c << endl;
}
```

Problem (5) [10 points] In the main() below, state the variables and values contained in both "x" and "y". Then state what variables could be accessed in "x.foo()" and "y.foo()".

```
class A {
private:
    int aPri;
protected:
    int aPro;
public:
    A();
    A(int a, int b);
};
A::A() {
    aPri=5;
    aPro=007;
}
A::A(int a, int b) {
    aPri = a;
    aPro = b;
}
class B : public A {
public:
    int bPub;
    B();
    B(int b);
    void foo(); // not defined
};
B::B() {
    bPub = 8;
}
B::B(int b) : A(b+1, b-1) {
    bPub = b;
}
class C : public B {
private:
    int cPri;
public:
    C();
    void foo(); // not defined
};
C::C() : B(0) {
    cPri = 3;
}
int main() {
    C x; // x.foo();
    B y; // y.foo();
```

Problem (6) [10 points] Assume there exists classes "Cat" and "Dog" which are children of the class "Pet". Assume the "Cat" and "Dog" classes have a "jump()" function. Write (in C++) code that makes an array of 5 pets with each element a 50% chance of being a "Cat" and 50% chance of being a "Dog". After the array is filled completely, run the "Cat" or "Dog" "jump()" function on each element. In addition to doing the two things above, also write the "Pet" class to work with your code.

Problem (7) [10 points] Below is a main(). Write additional (C++) code to make the output "2.5 3".

```
int main()
{
    Problem7 x;
    x.a = 3;
    x.b = 2.5;
    +x;
    cout << x.a << " " << x.b << endl;
}
```

Problem (8) [10 points] Find 3 errors in the code below. Assume that the code is completely shown except for #includes and "using namespace std". For each error, identify whether it is a runtime error, syntax error or logic error. You must also precisely describe why you think the part of code you identify is an error.

```cpp
class Problem8 {
public:
    int** x;
    Problem8();
    ~Problem8();
};

Problem8::Problem8() {
    x = new int[4];
    for(int i=0; i < 4; i++)
    {
        x[i] = new int;
        *x[i] = i;
    }
}

Problem8::~Problem8() {
    delete [] x;
    for(int i=0; i < 4; i++)
    {
        delete x[i];
    }
}

int main() {
    Problem8 a;
    Problem8* b = a;
    cout << a.x[0][0] << " " << b.[0][0] << endl;
}
```

Problem (9) [10 points] Which of the following loops give the same output for all values
of "x"?

(1)
```cpp
for(int i=x; i < 10; i++) {
    cout << i << endl;
}
```

(2)
```cpp
int i=x;
while(i < 10) {
    cout << i << endl;
    i++;
}
```

(3)
```cpp
int i=x;
do {
    cout << i << endl;
    i++;
}while(i < 10);
```

(4)
```cpp
int i=x;
while(i < 10) {
    if(i==5) {
        continue;
    }
    cout << i << endl;
    i++;
}
```

(5)
```cpp
for(int i=x; i < 10; i++) {
    if(i==5) {
        continue;
    }
    cout << i << endl;
}
```

Problem (10) [10 points] Write C++ code to overload the reverse() function below. This overloaded reverse() should take 3 inputs: a string, a "start index" and a "length". The overloaded reverse() should only reverse "length" characters starting at the "start index" and otherwise not change the string (example below).

```
string reverse(string in) {
    for(int i=0;i < in.length()/2; i++)
    {
        char temp = in[i];
        in[i] = in[in.length()-1-i];
        in[in.length()-1-i] = temp;
    }
    return in;
}


int main() {
    cout << reverse("Almost done!") << endl;
    //above prints: !enod tsomlA

    cout << reverse("Almost done!", 1, 4) << endl;
    //above prints: Asomlt done!
}
```

Problem (11) [10 points] Write C++ code that reads all lines in "input.txt" and puts them in reverse line order into "output.txt". You may assume both files open successfully. You may assume "input.txt" contains fewer than 1,000 lines.

```
Example "input.txt":
first
my cousin-once-removed was quaffing when he suddenly guffawed
the cake is a lie
y u no compile?!


Resulting "output.txt":
y u no compile?!
the cake is a lie
my cousin-once-removed was quaffing when he suddenly guffawed
first
```

Problem (12) [10 points] Write C++ code that reads two sentences from the keyboard. Then print out all characters which have the same index in both sentences. You may assume only lower case characters are used.

```
Example:
Sentence 1 = i'm very happy today
Sentence 2 = aim for shaming blame
Output = m haa
```