

# University of Washington Bothell

## CSS 342A: Data Structures, Algorithms, and Discrete Mathematics

### Quiz

Monday, October 13, 2014

1. The following global function takes as input parameters an array of bird objects as defined in Bird.h and the length of the array. It returns the bird with the largest wing span. There are multiple errors with the code. Please clearly identify them, including style issues.

#### Bird.h

```
class Bird
{
public:
    Bird();
    ~Bird();
    int WingSpan;
};
```

#### Main.cpp

```
const int MAXBIRDS 14;

int main()
{
    Bird biggest, b[MAXBIRDS];
    ...some code assume is ok ...
    biggest = LargestWingSpan(b, MAXBIRDS);
    return 0;
}

Bird& LargestWingSpan(Bird *birds, int &Length)
{
    int i;
    Bird bigBird("name");

    bigBird = birds[i];
    for (i = 1; i <= Length; i++)
    {
        if (birds[i].WingSpan > bigBird.WingSpan) bigBird = birds[i];
    }
    return bigBird;
}
```

2. A complex number can be expressed as  $a + bi$  where  $a$  and  $b$  are real numbers and  $i$  is the imaginary unit. The multiplication of two complex numbers is defined as follows:

$$(a + bi)(c + di) = (ac - bd) + (bc + ad)i.$$

Define a class which represents a complex number. The only member functions you have to define and implement are those which overload the  $*$  and  $*=$  symbols.

3. Implement the following theorem which determines the greatest common denominator (gcd) of two integers using recursion. How many times is the recursive function called for  $a = 4095$ ,  $b = 2590$ .

Theorem: If  $a$  and  $b$  are positive integers with  $a > b$  and  $b$  is not a divisor of  $a$ , then  $\text{gcd}(a, b) = \text{gcd}(b, a \bmod b)$ .

4. Circle the lines of code below would have compiler errors? Put a line through those which would have runtime errors? Assume the .h file from problem 1.

```
Bi rd Bi rd::TheCoop(Bi rd b1, const Bi rd &b2, Bi rd &b3) const
{
    i nt x = b2. Wi ngSpan;
    Wi ngSpan = b1. Wi ngSpan;
    thi s->Wi ngSpan = b3. Wi ngSpan;
    b3. Wi ngSpan = Wi ngSpan;
    b2. Wi ngSpan = b3. Wi ngSpan;
    b2. Wi ngSpan = 8;
    b3. Wi ngSpan = x;
}
```

5. A piggy-bank is to be utilized in a program and needs to be modelled with a C++ class. Define an interface for the piggybank by showing the PiggyBank.h file. There is no need to implement the bank.

One should be able to add coins to the bank (pennies, nickels, dimes, quarters), empty the bank, combine banks, print out contents of the bank, and other things you believe a bank should do.