

CS2134 Homework 2

Fall 2016

Due* 11:00 p.m. Saturday September 24, 2016

September 16, 2016

Assignment 2 includes a programming portion and a written portion. The programming portion must compile and should consist of a single file (hw02.cpp). The written portion should consist of a single file (hw02written) in a *.pdf* format. Be sure to include your name at the beginning of each file! You must hand in both files via NYU Classes. *No late assignments will be accepted.*

Programming Part:

1. For the class called `IntArray` implement a deep copy constructor, a move constructor, a destructor, and a move assignment operators. Use the `std::swap` function if appropriate, and below where you used the `std::swap` function, write as a comment the code to perform the same steps without using the `std::swap` function.

Implement the methods outside the class interface.

You may implement the `put` and `get` methods to test your code. You will not be graded on these methods.

Nicolai, our TA, has created a *unit test* for this question.¹ Your code must pass this unit test. The unit test is in a file called `main.cc`.

```
class IntArray{
public:

    IntArray(int n = 0): size(n), array(new int[n]){}
    // add your methods here

    void put (int i, int value);
    int get( int i);
private:
    int * array;
    int size;
};
```

*A bonus of %5 percent will be given if you turn in this homework assignment by Friday September 23th at 11:00 p.m.

¹We will introduce unit testing next week.

2. Write a functor to determine if an integer is even or odd.
3. Write a functor that compares two strings, `str1` and `str2`. If `str1`'s length is less than `str2`'s length, your functor returns `true`. Otherwise it returns `false`.

Written Part

1. What is printed if you ran the following code. Would this be what you wanted to happen? Is there anything that goes wrong?

```
class IntArray{
public:

    IntArray(int n = 0): size(n), array(new int[n]){}
    void put (int i, int value);
    int get( int i);
private:
    int * array;
    int size;
};
void someFun( )
{
    IntArray myA1( 1 );
    IntArray myA2( myA1 );
    IntArray myA3( 1 );
    myA1.put( 0, 12 );
    cout << myA1.get( 0 ) << endl;
    myA2.put( 0, 10 );
    cout << myA1.get( 0 ) << endl;
    myA3.put( 0, 5 );
    myA1 = myA3;
    cout << myA1.get( 0 ) << endl;
}
int main(int argc, const char * argv[])
{
    someFun( );
}
```

2. For each of the following code fragments, determine the worst case running time using **Big-Oh** notation as a function of n .

(a)

```
int sum = 0;
for (int k = n; k>=1; k = (int) k/3)
    sum += k;
cout << sum;
```

```

(b) for (int j = 1; j <= n; j++)
{
    for (int i = j; i > 1; i/=9)
        cout << "(" << i << ", " << j << ") " ;
    cout << endl;
}

(c) template <class Comparable>
int min(const vector<Comparable> & items)
{
    if (items.size() == 0) return -1;

    int min_index = 0;

    for (int i = 0; i < items.size(); ++i)
        if (items[i] < items[min_index])
            min_index = i;

    return min_index;
}

(d) for( i = 0; i < n; ++i)
    for( j = 0; j < n; ++j)
        a[i][j] = b[i][j] + c[i][j];

(e) void in_order( vector<int> & a )
{
    int j = 0;
    for( int p = 1; p < a.size( ); p++ )
    {
        print(a); // This function takes O(n) time.
        Comparable tmp = a[ p ];
        for( j = p; j > 0 && tmp < a[ j - 1 ]; j-- )
            a[ j ] = a[ j - 1 ];
        a[ j ] = tmp;
    }
}

```

```

(f) void f( vector<int> v )
    {
        if ( v.size( ) > 0 )
            v[0] = 1;
    }
int main( )
{
    // some code to create a vector of size n that you do not include in your run time
    f( v );
}

```

3. What is the difference between `delete []` and `delete`?
4. For programming problem 1, Using *big-Oh* notation if `size = n`, give the worst case running time for the:
 - (a) copy constructor
 - (b) move constructor
5. Using *big-Oh* notation what is the running time of the following code snippets where `v` is a vector of `n > 0` integers.

```

(a) void f( vector<int> b )
    {
        cout << b[0];
    }
int main( )
{
    // code to create the vector v which will not be included in your run time
    f( v );
}

```

```

(b) void f( vector<int> & b )
    {
        cout << b[0];
    }
int main( )
{
    // code to create the vector v which will not be included in your run time
    f( v );
}

```

6. If your code contained the following functions²

```
// Function 1
void f( const string & s )
{
    cout << "Function 1 was called." << endl;
}

// Function 2
void f( string & s )
{
    cout << "Function 2 was called." << endl;
}

// Function 3
void f( string && s )
{
    cout << "Function 3 was called." << endl;
}
```

State which function was called for each of the following.

- (a) `f(string("hello"));`
- (b) `string s1 = "hello";`
`f(s1);`
- (c) `string s2 = "hello";`
`f(std::move(s2));`
- (d) `const string s3 = "hello";`
`f(s3);`

7. Determine if the specified expression is an *rvalue* or an *lvalue*:

- `int x = 3; // what is x`
- `char * ptr = new char[3]; // what is new char[3]`
- `int f() return 1; // What is the return value of the function f`
- `string && sRef = string("What?"); // what is sRef`

²Please run these functions to check your answer. Do not turn in your code.

8. Anything wrong with this code? If there is, please describe what the problem is, otherwise state there is no problem.

```
string & getName( )
{
    string name;
    cout << "Please enter your name: ";
    cin >> name;
    cout << "Hi " << name << '!' << endl;
    return name;
}
int main( )
{
    cout << getName( );
}
```