

Full Class Array (with Big Three)

```
template <typename T>
class ABQ {
    private:
        T* data;
        size_t current_size;
        size_t max_capacity;
        size_t front;
        size_t back;
        float scale_factor;
    public:
        ABQ() {
            this -> max_capacity = 1;
            this -> current_size = 0;
            this -> front = 0;
            this -> back = 0;
            this -> scale_factor =
                2.0f;
            data = new T[max_capacity];
        }
        ABQ(int capacity) {
            this -> max_capacity =
                capacity;
            this -> current_size = 0;
            this -> front = 0;
            this -> back = 0;
            this -> scale_factor =
                2.0f;
            data = new T[max_capacity];
        }
        ABQ(const ABQ &d) {
            this -> max_capacity =
                d.max_capacity;
            this -> current_size =
                d.current_size;
            this -> front = d.front;
            this -> back = d.back;
            this -> scale_factor =
                d.scale_factor;
            data = new T[max_capacity];
            for (size_t i = 0; i <
                current_size; i++) {
                data[i] = d.data[i];
            }
        }
};
```

Full Class Array (with Big Three) (cont)

```
> }
}
ABQ &operator=(const ABQ &d) {
    if (this != &d) {
        delete [] data;
        this -> max_capacity = d.max_capacity;
        this -> current_size = d.current_size;
        this -> front = d.front;
        this -> back = d.back;
        this -> scale_factor = d.scale_factor;
        data = new T[max_capacity];
        for (size_t i = 0; i < current_size; i++) {
            data[i] = d.data[i];
        }
    }
    return *this;
}
~ABQ() {
    delete [] data;
}
```

Module 1

```
#pragma once // prevents
including multiple times
#include "functions.h" // gets
functions & classes from file
#include <iostream> //
includes official string
directory
FUNCTIONS
int addNum(int x, int y); //
prototype
int addNum(int a, int b) { //
definition
    return a + b;
}
```

Pointers

```
int x = 16;
int *xPtr = &x; // Creates
pointer int *xPtr2 = &x; // Also
works
int* ptr = nullptr; // Points to
nothing
*xPtr = 10; // Changes x
// References must be initia -
lized
int& xRef = x; // Creates
reference to x int &xRef2 = x;
// Also works
// xRef and x have same memory
address
xRef = 10; // Changes x and xRef
// Changes variable passed in
through pointer
void passByPointer(int* x) {
    *x = 30;
}
// Changes variable passed in
through reference
void passByRef (int& x) {
    x = 40;
}
```

Constant

```
Foo::Foo(const Foo&); // passes
in the parameter as a const
const int Foo::getData(); //
returns a const int
int Foo::getCoun t(int index)
const; // makes function const
int someVal = 50;
// Cannot modify the value by
dereferencing a pointer
const int* pointer1 = &someVal;
// Cannot change the address the
pointer is pointing to
int* const pointer2 = &someVal;
const int* const pointer3 = &someVal; // Can't change anything
```

C Style

In C, the end of a char* C-style string is defined by the null terminator ('\0'). This special character marks the end of the string in memory, allowing functions like strlen(), strcpy(), and strcmp() to know where the string ends. Without the null terminator, these functions would continue reading memory beyond the string, causing errors. For example, the string "Hello" in memory is stored as ['H', 'e', 'l', 'l', 'o', '\0']. The most common way to define a null-terminated string in C is by using a string literal, such as char str[] = "Hello";, which automatically includes the null terminator. Defining a string manually without the null terminator, like char str[] = {'H', 'e', 'l', 'l', 'o'};, is incorrect because it doesn't mark the end of the string. Another valid but less common way is char str[] = {'H', 'e', 'l', 'l', 'o', '\0'};. However, using string literals is the preferred and more concise method..

Operator Overloading

```
DynamicArray operator+(const
DynamicArray& other) {
    int newSize = max(size,
other.size);
    DynamicArray temp(n
ewSize); // Create new array
with size based on the max size
    for (int i = 0; i < size
&& i < other.size; ++i) {
        temp.arr[i] =
arr[i] + other.arr[i];
    }
    return temp;
}
DynamicArray& operator+ =
(const DynamicArray& other) {
```

Operator Overloading (cont)

```
> int newSize = max(size, other.size);
if (newSize > capacity) {
    resize(newSize); // Resize if necessary
}
for (int i = 0; i < other.size; ++i) {
    arr[i] += other.arr[i];
}
size = newSize;
return *this; // Return current object for
chaining
}
DynamicArray operator-(const DynamicAr
ray& other) {
    int newSize = max(size, other.size);
    DynamicArray temp(newSize); // Create
new array with size based on the max size
    for (int i = 0; i < size && i < other.size; ++i)
{
        temp.arr[i] = arr[i] - other.arr[i];
    }
    return temp;
}
DynamicArray& operator-=(const Dynami
cArray& other) {
    int newSize = max(size, other.size);
    if (newSize > capacity) {
        resize(newSize); // Resize if necessary
    }
    for (int i = 0; i < other.size; ++i) {
        arr[i] -= other.arr[i];
    }
    size = newSize;
    return *this; // Return current object for
chaining
}
bool operator==(const DynamicArray&
other) const {
```

Operator Overloading (cont)

```
> if (size != other.size) {
    return false;
}
for (int i = 0; i < size; ++i) {
    if (arr[i] != other.arr[i]) {
        return false;
    }
}
return true;
}
bool operator!=(const DynamicArray& other)
const {
    return !(*this == other); // Using ==
operator
}
```



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Page 2 of 2.

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