

C++ PROGRAMMING

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Contents

68. Array of Objects

OBJECTIVES

- Review Array and pointer
- Use Arrays to store objects
- Build static sized Array Objects
- Build static sized Array Object Pointers
- Build dynamic sized Array Object
- Build dynamic sized Array Object Pointers

Review

As you know, the size of the array is fixed:

```
const int SIZE = 5;
int x[2 * SIZE];      // OK
int y[42];            // OK
int i = 5;
int z[i];              // WRONG!!!
```

For a “dynamic” array, i.e., an array whose size can be variable, you can use a pointer.

```
int * p = new int[5];      // OK
const int SIZE = 5;
int * q = new int [2 * SIZE]; // OK
int i = 5;
int * r = new int[i]; // OK!!!
```

Memory allocated to a pointer must be de-allocated by the programmer:

```
int i = 5;
int * r = new int[i];
// do something with r[0], ..., r[i -- 1]
delete [] r;
```

Memory can be allocated to a pointer more than once. The sizes can be different.

```
int * r = new int[5];
// ... do something with r[0], ..., r[4]
delete [] r;
...
r = new int;
// ... do something with *r;
delete r;
...
r = new int[10];
// ... do something with r[0], ..., r[9]
delete [] r;
```

Like a pointer to a structure variable, if `p` points to an object with instance variable `x`, then

`(*p) . x` is the same as `p-> x`

Similarly if the object has method `m()`, then invoking

`(*p).m()` is the same as `p->m()`

Use `->` instead of `*`.

Array of Objects

So far objects are created individually.

What if you want to create an array of objects

```
C obj[10];
```

where C is the class?

Try the following example:

```
// Int.h
#include <iostream>
class Int
{
public:
    Int(int x=0)
        : x_(x)
    {
        std::cout << "Int ... x_: " << x_
                    << std::endl;
    }
private:
    int x_;
};
```

```
#include "Int.h"
int main()
{
    Int a[10];
    return 0;
}
```

The Point: Each `a[i]` ($i=0, \dots, 9$) is constructed using the default constructor. When you declare an array of objects each object in the array calls the **default constructor**.

You **must** have a default constructor if you want to have an array of objects. (Don't forget that if you don't specify any constructor, C++ will give you a default constructor.)

Of course you can still call the constructor one at a time like this if you wish:

```
Int a[3] = Int(3), Int(-1), Int(42);
```

Now try to run this (why does it not work):

```
// vec2d.h
#include <iostream>
class vec2d
{
public:
    vec2d(double x, double y)
        : x_(x), y_(y)
        {}
private:
    double x_, y_;
};
```

```
#include "vec2d.h"

int main()
{
    vec2d v[10];
    return 0;
}
```

The point: Each of the `v[0], ..., v[9]` calls `vec2d()` (the default constructor) to initialize itself. But there is no default constructor in `vec2d`. There's only one constructor and it must receive two doubles.

Remember that! If you want to declare an array of objects without an initializer list, you **MUST** have the default constructor used to construct the objects in the array.

Exercise -1.0.1. Fix the following class so that an array of `WeatherControl` objects can be created with all instance variables initialized to 10.

```
// WeatherCtrl.h
#ifndef WEATHERCTRL_H
#define WEATHERCTRL_H

class WeatherCtrl
{
public:
    WeatherCtrl(double temp, double pressure)
        : temp_(temp), pressure_(pressure)
    {}
    double get_temp() const { return temp_; }
    double get_pressure() const { return pressure_; }
    void set_temp(double);
    void set_pressure(double);
private:
    double temp_;
    double pressure_;
};

#endif
```

Suppose we have the following class:

```
class Int
{
public:
    Int(int x)
        : x_(x)
    {}
private:
    int x_;
};
```

Now suppose you want to create an array of `Int` objects with

```
Int a[10]; // want a[i].x = i
```

First Method:


```
class Int
{
public:
    Int (int x = 0)
        : x_(x) {}
    void set(int a) { x_ = a; }
private:
    int x_;
};

int main()
{
    Int a[10];
    for (int i = 0; i < 10; ++i)
        a[i].set[i];
    ...
}
```

1. Forced to have a default constructor.

2. Construct each `a[i]` with default constructor.

Important point:
Two methods called for each object to set the initial values.

3. set each object.