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## Foundations of C++ and Object-Oriented Programming

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# Multidimensional Arrays

Array support in C++ is not limited to single-dimensional arrays. Rather, it extends to multidimensional arrays. This chapter looks at declaring, accessing, and initializing multidimensional arrays. In addition, the chapter discusses declaring multidimensional arrays as function parameters. You will also learn about sorting multidimensional arrays using the `combsort` method, as well as searching multidimensional array elements using the linear and binary search methods.

## Declaring Multidimensional Arrays

C++ requires that you declare a multidimensional array before you use it. The general syntax for declaring a multidimensional array is:

```
type arrayName[numberOfElement1][numberOfElement2]....
```

The above syntax shows the following aspects:

- The declaration starts by stating the basic type associated with the array elements. You can use predefined or previously defined data types.

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- The name of the array is followed by a sequence of the number of elements for the various dimensions. These numbers appear in square brackets. Each number of elements must be a constant (literal or symbolic) or an expression that uses constants.

All multidimensional arrays in C++ have indices that start at 0. Thus, the number of array elements in each dimension is one value higher than the index of the last element in that dimension.

Here are examples of declaring multidimensional arrays:

```
// example 1
int nIntCube[20][10][5];
// example 2
const int MAX_ROWS = 50;
const int MAX_COLS = 20;
double fMatrix[MAX_ROWS][MAX_COLS];
// example 3
const int MAX_ROWS = 30;
const int MAX_COLS = 10;
char cNameArray[MAX_ROWS+1][MAX_COLS];
```

The first example declares the `int`-type three-dimensional array `nIntCube` with 20 by 10 by 5 elements. The declaration uses the literal constants 20, 10, and 5. Thus, the indices for the first dimension are in the range of 0 to 19, the indices for the second dimension are in the range of 0 to 9, and the indices for the third dimension are in the range of 0 to 4.

The second example declares the constants `MAX_ROWS` and `MAX_COLS` and uses these constants to specify the number of rows and columns of the `double`-type matrix `fMatrix`.

The third example declares the `char`-type matrix `cNameArray`. The constant expression `MAX_ROWS + 1` defines the number of rows in the array `cNameArray`. The constant `MAX_COLS` defines the number of columns in the array `cNameArray`.

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