Arrays

Functions in `<cctype>` (Handy for Lookahead)

Function	Accepted Characters
isdigit	0 ... 9
isalpha	a ... z, A ... Z
islower	a ... z
isupper	A ... Z
isalnum	a ... z, A ... Z, 0 ... 9
isspace	White space (space, tab, newline, and the rarely used carriage return, form feed, and vertical tab)

Arrays

Using Arrays

Think of a list of values - sales per month in 2023

```
32 54 67.5 29 35 80.3 115 98 100 65 210.5 140
```

(all of the same type, of course)

(storable as **`double`**s)

Using Arrays

```
32 54 67.5 29 35 80.3 115 98 100 65 210.5 140
```

Which is the largest value in this set?

(You must look at every single value to decide.)

Using Arrays

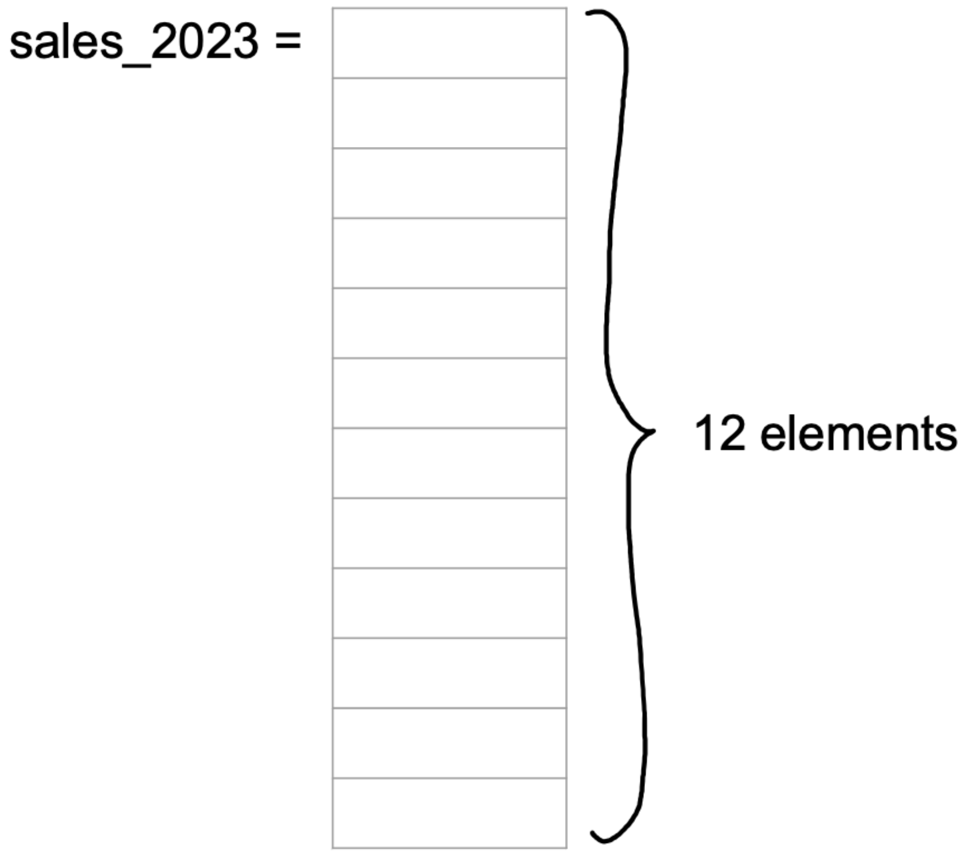
32 54 67.5 29 35 80.3 115 98 100 65 210.5 140

- So you would create a variable for each, of course!

```
double jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec;
```

Then what ???

Defining Arrays



An “array of double”

Twelve elements of **double** type can be stored under one name as an array.

double sales_2023[12];

type of each element

number of elements – the “size” of the array, must be a constant

Introduction to Arrays

Definition: An array is a collection of data of the same type, referenced as different elements of the same name.

- First "aggregate" data type
  - Means "grouping"
  - *int, float, double, char* are simple data types
- Used for lists of like items
  - Test scores, temperatures, names, etc.
  - Avoids declaring multiple simple variables
  - Can manipulate "list" as one entity

Declaring Arrays

Declare the array → allocates memory

```
int score[5];
```

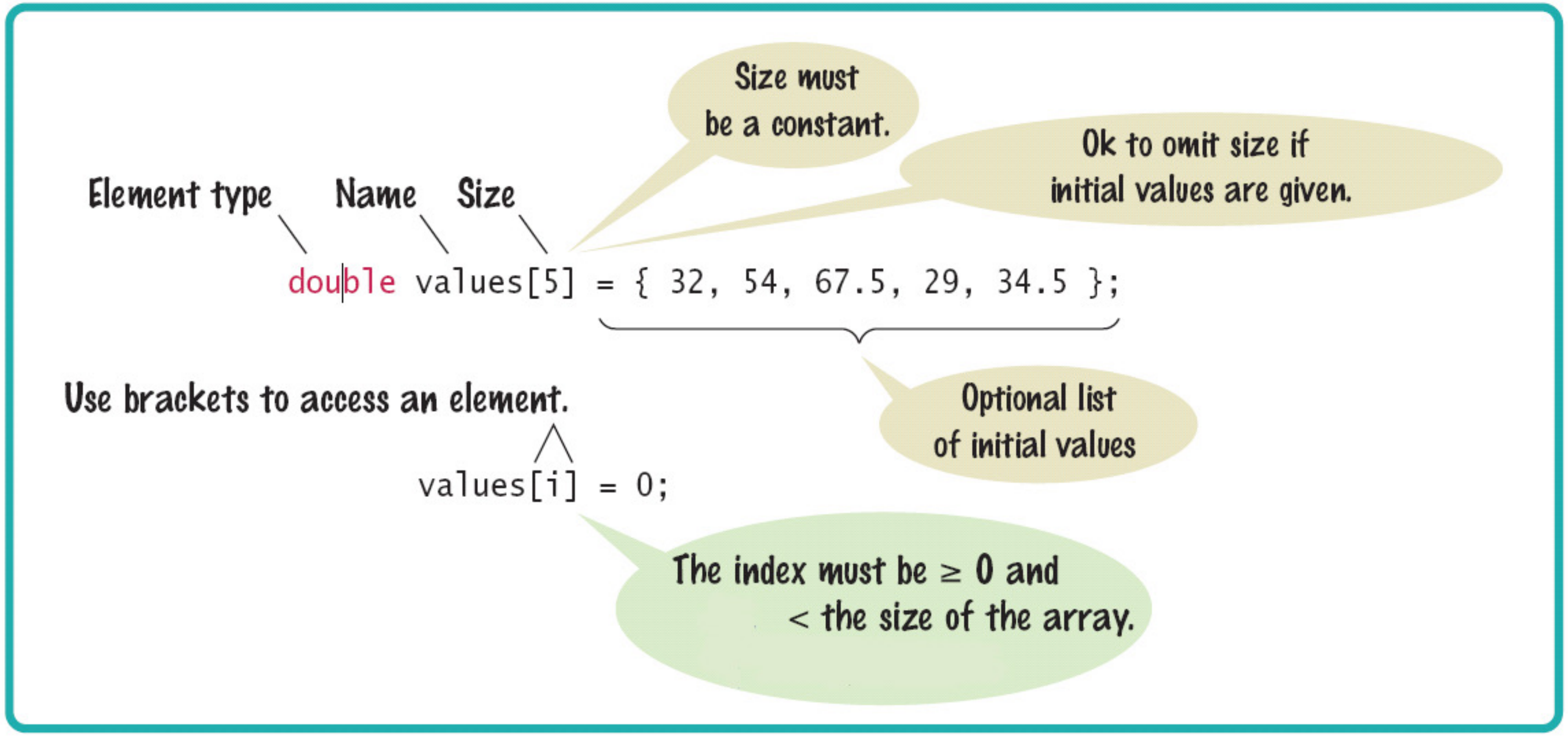
- Declares array of 5 integers named "score"
- Similar to declaring five variables:

  ```
  int score[0], score[1], score[2], score[3], score[4];
  ```

- Individual parts can be called many things:
  - Indexed or subscripted variables
  - "Elements" of the array
  - Value in brackets is called index or subscript
  - Numbered from 0 to (size – 1)

Array Syntax

Defining an Array



```
double values[5] = { 32, 54, 67.5, 29, 34.5 };

values[i] = 0;
```

Element type
Name
Size
Size must be a constant.
Ok to omit size if initial values are given.
Optional list of initial values
Use brackets to access an element.
The index must be ≥ 0 and < the size of the array.

Brief C++ by Cay Horstmann

Accessing Arrays

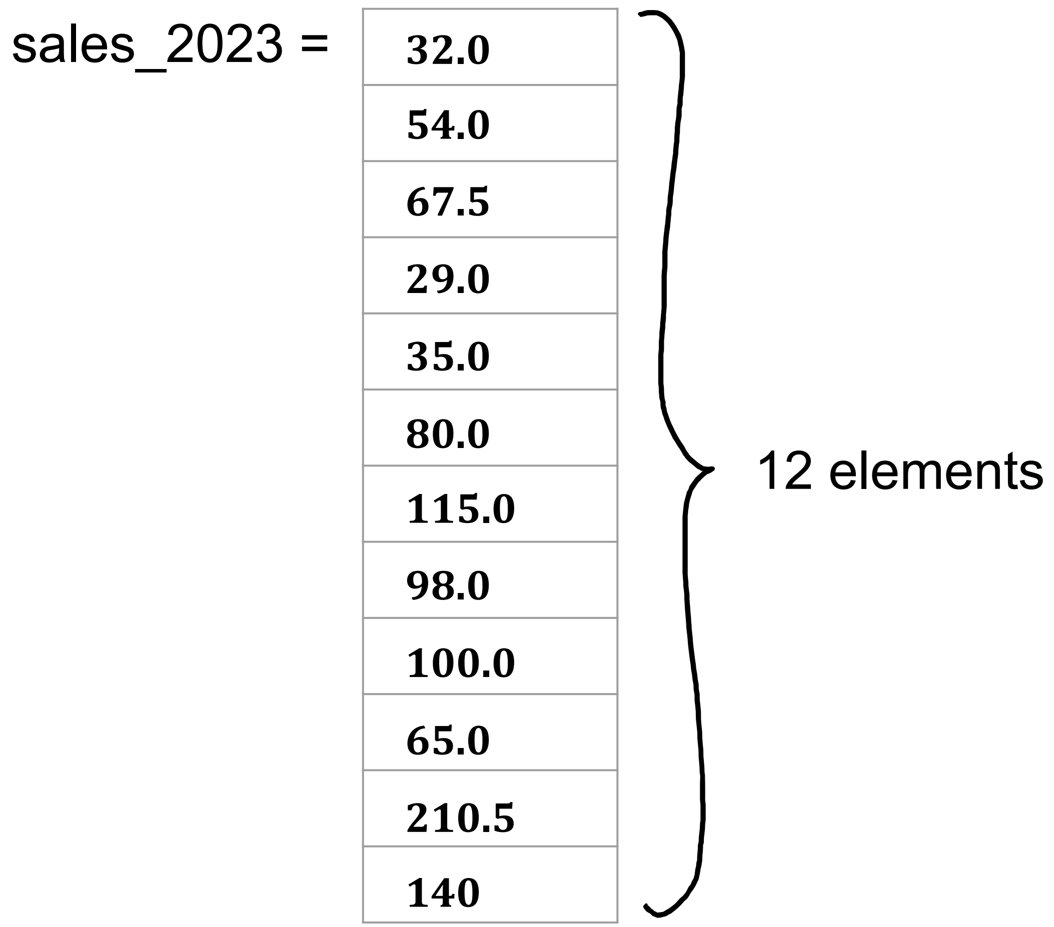
- Access using index/subscript

```
cout << score[3];
```

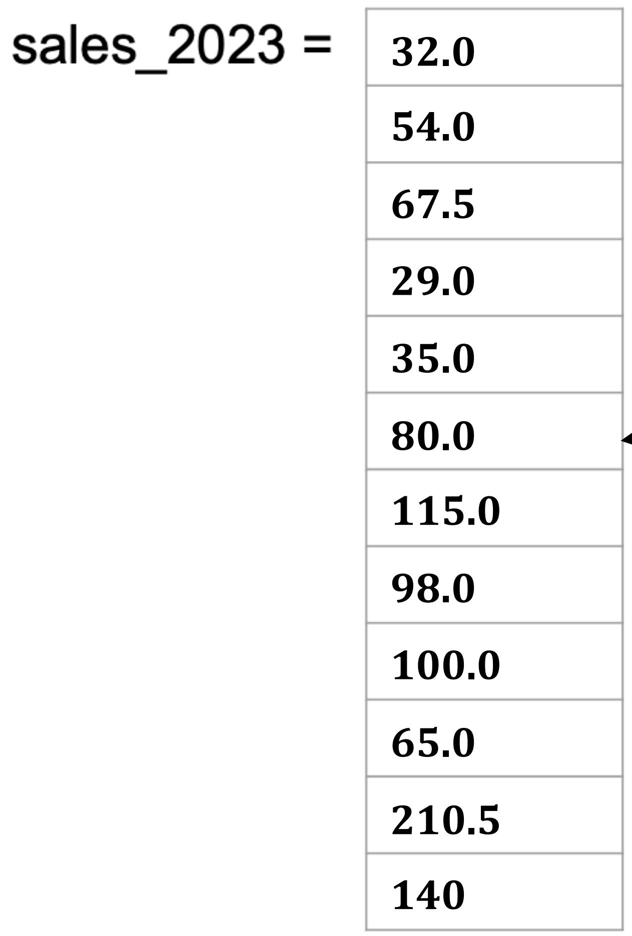
- Note two uses of brackets:
  - In declaration, specifies SIZE of array
  - Anywhere else, specifies a subscript
- Size, subscript need not be literal

```
int score[MAX_SCORES];
score[n+1] = 99;   -->
```
If n is 2, identical to: score[3]

Accessing Arrays



Accessing an Array Element



To access the element at index 5 using this notation:

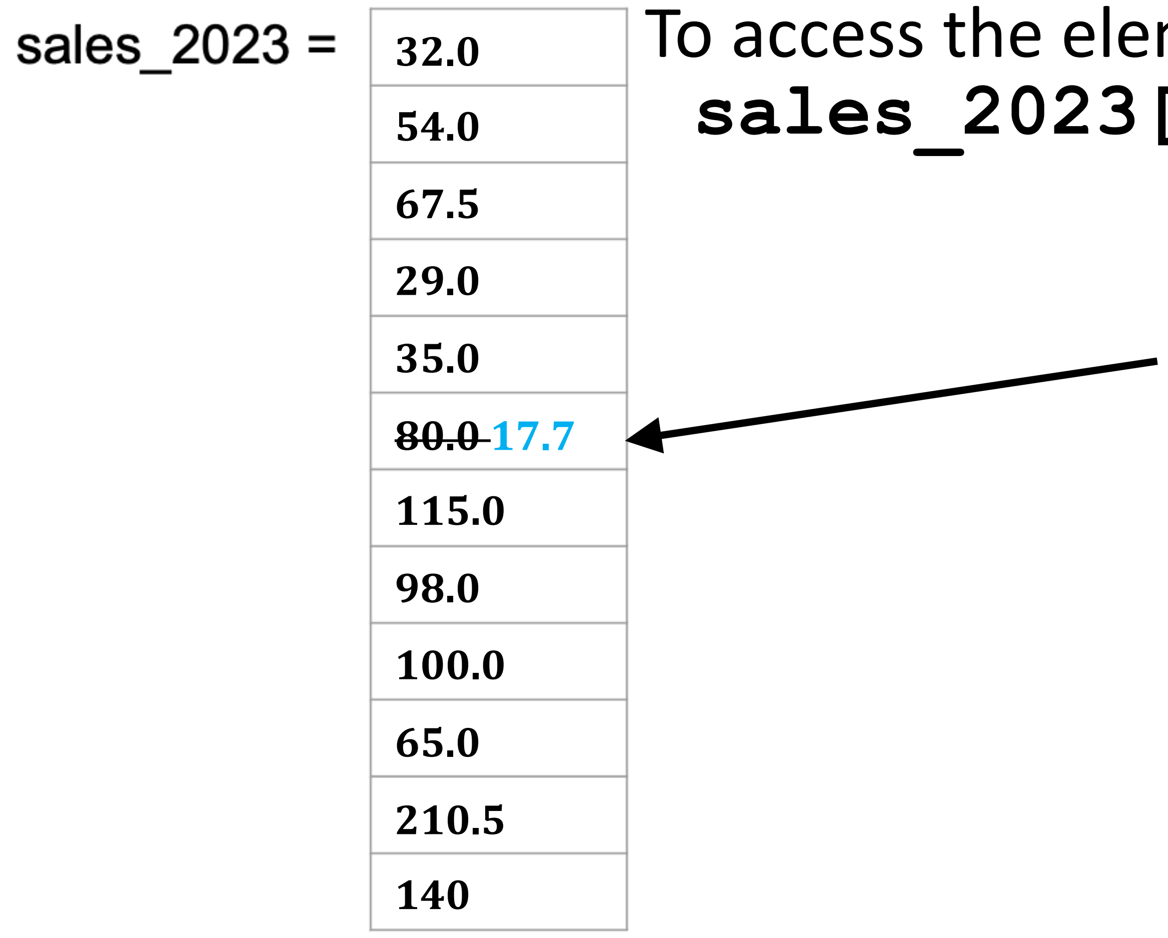
```
sales_2023[5]
```

5 is the *index*.

```
double sales_2023[12];
...
cout << sales_2023[5] << endl;
```

The output will be **80**

Accessing an Array Element



To access the element at index 5 using this notation:

```
sales_2023[5]
```

5 is the *index*.

```
sales_2023[5] = 17.7;
...
cout << sales_2023[5] << endl;
```

The output will be **17.7**

Accessing an Array Element

- That is, the legal elements for the **sales_2023** array are:
- sales_2023[0] , the first element
- sales_2023[1] , the second element
- sales_2023[2] , the third element
- sales_2023[3] , the fourth element
- sales_2023[4] , the fifth element
- ...
- sales_2023[11] , the twelfth and last legal element
- recall: double sales_2023[12];

- The index must be >= 0 and <= 11.

- 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 is ... 12 numbers.

Array Usage

- Powerful storage mechanism
- Can issue commands like:
    - "Do this to ith indexed variable”, where i is computed by program
    - "Display all elements of array score"
    - "Fill elements of array score from user input"
    - "Find highest value in array score"
    - "Find lowest value in array score”
- Disadvantages: size MUST BE KNOWN at declaration