What is an Array?

- It's a collection of variables (the same type) grouped into one name.

- More specifically, it's a group of memory locations for variables of the same type and specified by the same name.

- It makes dealing with related variables much easier.

Arrays

- An *array* is an ordered list of values

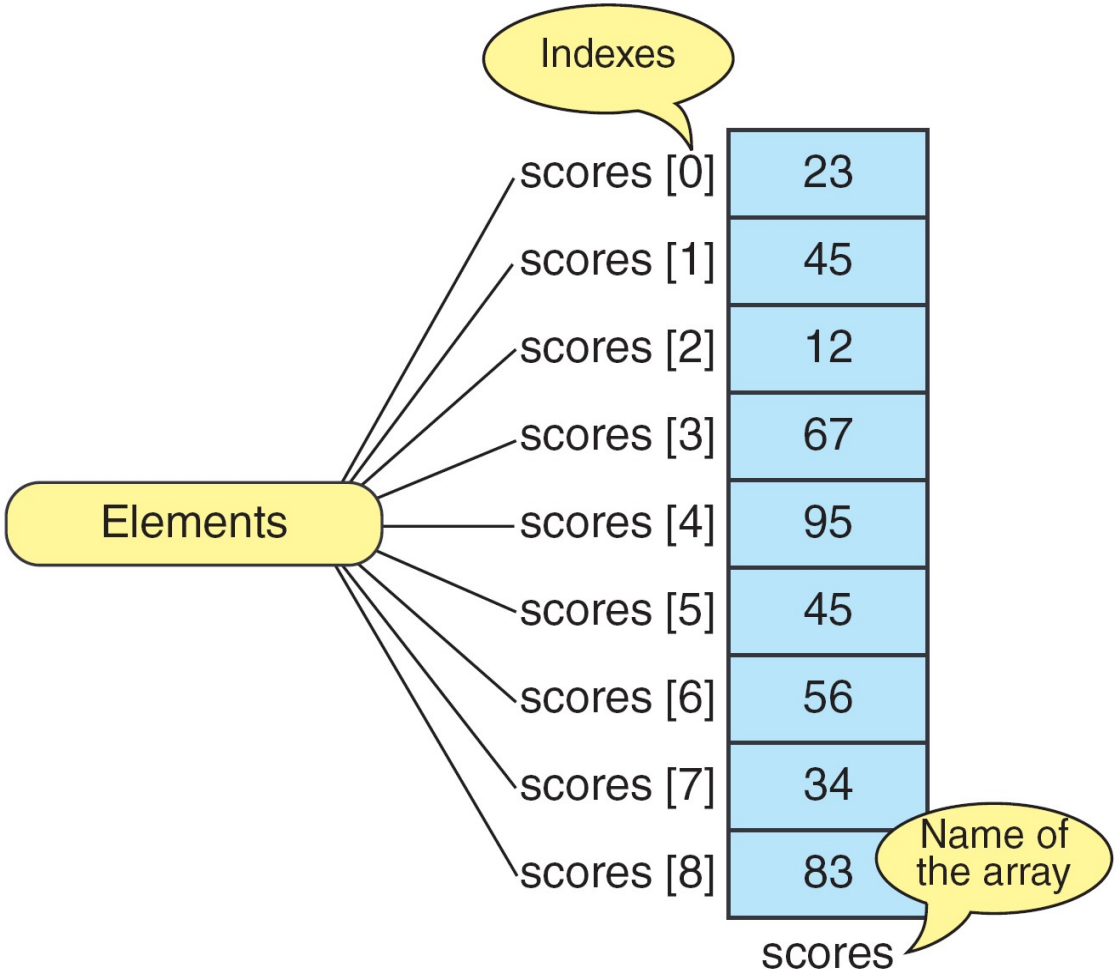
The entire array has a single name

Each value has a numeric *index*

	0	1	2	3	4	5	6	7	8	9
`scores`	79	87	94	82	67	98	87	81	74	91

An array of size N is indexed from zero to N-1

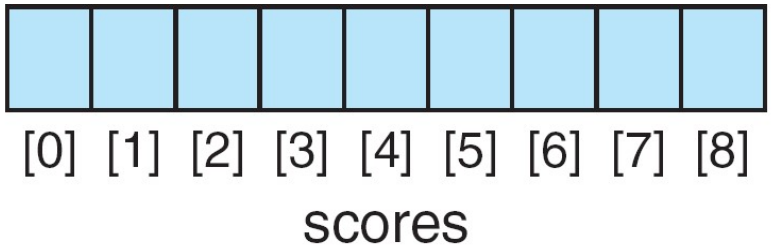
This array holds 10 values that are indexed from 0 to 9



The Scores Array

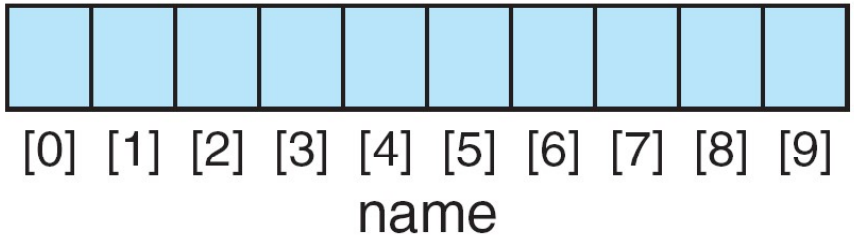
```
int scores [9];
```

type of each element



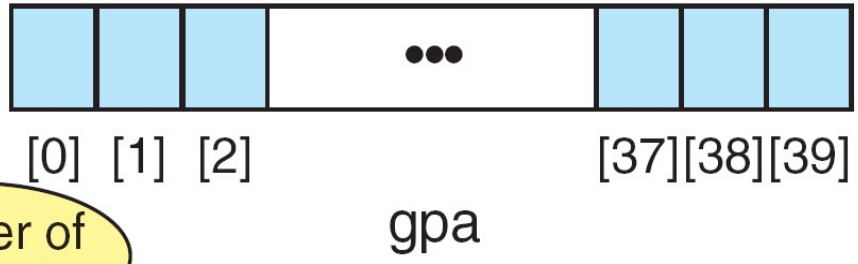

```
char name [10];
```

name of the array




```
float gpa [40];
```

number of elements



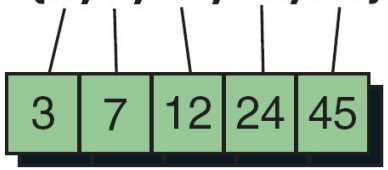
Declaring and Defining Arrays

Note

Only fixed-length arrays can be initialized when they are defined. Variable length arrays must be initialized by inputting or assigning the values.

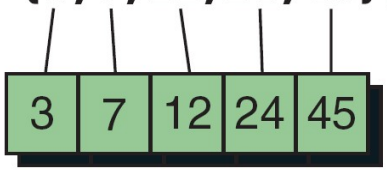
(a) Basic Initialization

```
int numbers[5] = {3,7,12,24,45};
```



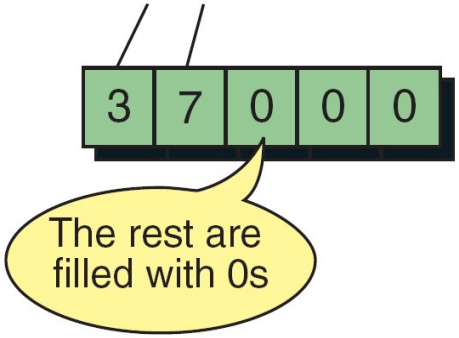
(b) Initialization without Size

```
int numbers[ ] = {3,7,12,24,45};
```



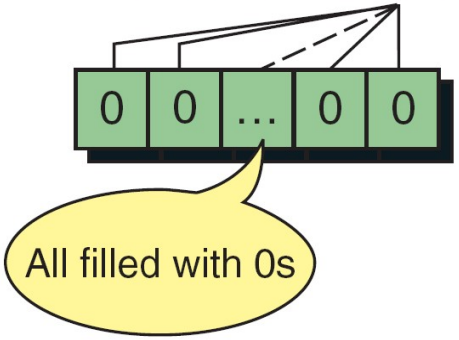
(c) Partial Initialization

```
int numbers[5] = {3,7};
```



(d) Initialization to All Zeros

```
int lotsOfNumbers [1000] = {0};
```



Initializing Arrays

Note

One array cannot be copied to another using assignment.

Array Input/ Output

- We typically use for loops for any kind of array processing.
- To input an array, one by one:

```
for (i=0; i<10 ; i++ )
{
  printf(" Enter element %d  : ", i );
  scanf ( " %d ", &scores[i] );
}
```

Array Output

- To display an array, one element per line:

```
for (i=0; i<10 ; i++ )
{
  printf(" scores [%d] : %d\n", i , scores[i]
 );
}
```

Example

- double X[ ]= {16.0, 12.0, 6.0, 8.0, 2.5, 12.0, 14.0, -54.5}
- int i=5;
- printf("%f", x[4]);
- printf("%f", x[i]+1);
- printf("%f", x[i+1]);
- printf("%f", x[2*i]);

Example

- double x[ ]= {16.0, 12.0, 6.0, 8.0, 2.5, 12.0, 14.0, -54.5}
- int i=5;
- printf("%f", x[2*i-3]);
- printf("%f", x[(int) x[4]]);
- printf("%f", x[i++]);
- printf("%f", x[--i]);
- x[i]= x[i+1];

Write a program to get the average of 10 integers in an array.

Solution

* Write a program to get the average of 10 integers in an array “A”.

```
Sum = 0 ;
For ( i=0 ; i<10 ; i++)
{
        Sum = Sum + A [ i ]
}
Avg = Sum / 10 ;
```

What is the type of : Sum , Avg ?

Trace the following Program and find its output

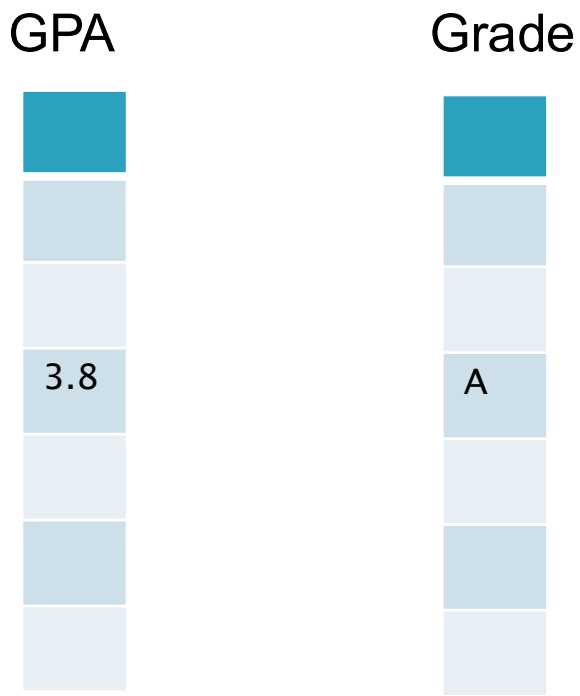
```
/* Histogram printing program */
#include <stdio.h>
#define SIZE 10
int main()
{
    int n[ SIZE ] = { 19, 3, 15, 7, 11, 9, 13, 5, 17, 1 };
    int i, j;
    printf( "%s%13s%17s\n", "Element", "Value", "Histogram" );
    for ( i = 0; i <= SIZE - 1; i++ )
    {
        printf( "%7d%13d        ", i, n[ i ]) ;
        /* print one bar */
        for ( j = 1; j <= n[ i ]; j++ )
            printf( "%c", '*' );
    printf( "\n" );
    }
     return 0;
}
```

```
printf( "%s%13s%17s\n", "Element", "Value", "Histogram" );
    for ( i = 0; i <= SIZE - 1; i++ )
    {
        printf( "%7d%13d        ", i, n[ i ]) ;
     for ( j = 1; j <= n[ i ]; j++ )
            printf( "%c", '*' );
    printf( "\n" );
    }
     return 0;
}
```

```
Element         Value         Histogram
      0            19         ******************
      1             3         ***
      2            15         ***************
      3             7         *******
      4            11         ***********
      5             9         *********
      6            13         *************
      7             5         *****
      8            17         *****************
      9             1         *
```

Parallel Arrays

- These are independent arrays of the same size, that have a meaningful connection to each other.
- For example, one array with a students gpa, and one with his letter grade.



Example: Stores
Problem Analysis Chart

Given Data	Required Results
1. 15 stores 2. Sales per store	Percent of total sales per store
Processing Required	**Solution Alternatives**
Percent (store) = sales (store)/total sales	Must use arrays

Solution

- Steps:
  - Enter the sales per store into an array sales[15]
  - Calculate the total sales (sum of array elements)
  - Fill a new array (percent [15]) with the %value of sales of each store
    - (percent[i] = (sales[i]/total)*100

Questions?