

Lecture 8

Arrays

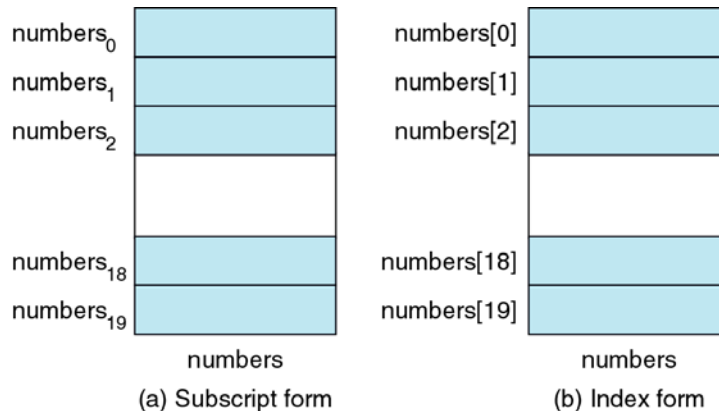
Today's Topics

- Array Concepts
- Using Arrays
- Arrays and Functions

Concept of an array

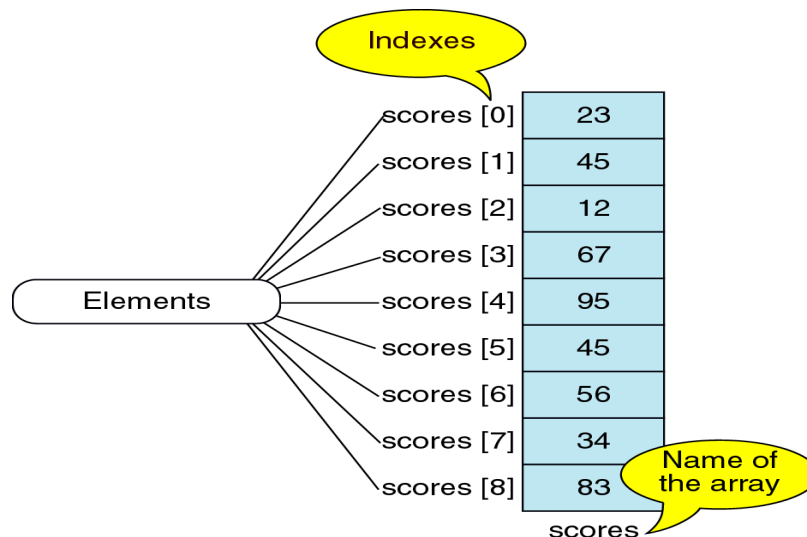
- An ordinary variable can only contain a single value
- An **array** is a variable that contains a **collection of values of the same type**. These values are stored in a sequential location.

Example:



Concept of an array

Terms



- A single value in an array is called an **element**
- An **index** (or a subscript) is a reference of an element
 - It is an integer number
 - Index **0** refers to the first element

Using arrays

- Two things to do when using arrays:
 - Declaration and definition of arrays
 - Accessing elements in arrays
 - for putting values
 - for getting values

Declaring and defining Arrays

- Since **an array is a variable**, it must be declared and defined before it can be used.
- Declaration and definition tell the compiler:
 - the **name** of the array
 - the **data type** of each element
 - the **number of elements** in the array

Syntax:

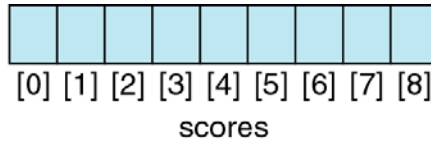
```
data_type variable_name [n] ; // n = number of elements
```

Declaring and defining Arrays

Examples:

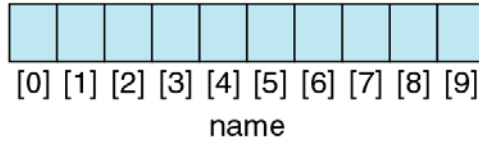
```
int scores [9];
```

type of each element



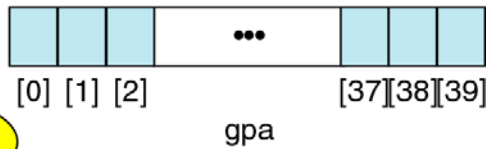
```
char name [10];
```

name of the array



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

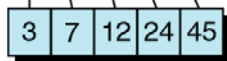
number of elements



Declaring and defining Arrays

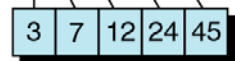
Like ordinary variables, arrays may also be initialized:

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



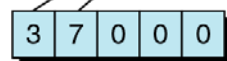
(a) Basic initialization

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



(b) Initialization without size

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



The rest are filled with 0s

(c) Partial initialization

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



All filled with 0s

(d) Initialization to all zeros

Accessing elements in arrays

- We use an index to access an element from an array
- The index must be in a valid range
 - The following example would be an error - array A has only 2 elements, but we try to access the third element which is not exist.

```
int A[2];
```

```
A[2] = 100; // this line would an error
```

- We access an element for two purposes:
 - assigning new value into it
 - getting its current value

Assigning values into elements

Examples:

1. Assigning a new value into the 2nd element of array A.

```
int A[] = {1,3,5,7};  
A[1] = 100;
```

2. Incrementing the value of 3rd element of array B.

```
int B[] = {11,23,35,47};  
B[2]++;
```

Assigning values into elements

Examples:

3. *Assigning each element of array C with a value that is twice its index*

```
int C[9];
int i;
for (i=0; i<9; i++)
    C[i] = i*2;
```

Assigning values into elements

Examples:

4. *Assigning each element of array D with a value that is read from the keyboard*

```
int D[5];
int i;

for (i=0; i<5; i++)
    scanf("%d", &D[i]);
```

Assigning values into elements

Examples:

5. *The following example would be an error - elements of an array must be assigned individually.*

```
int E[4];  
E = {10,20,30,40}; // this would be an error  
  
// solutions: - assign them individually.  
E[0]=10;  
E[1]=20;  
E[2]=30;  
E[3]=40;
```

Getting values from elements

Examples:

1. *Assigning variable n with the value of first element of array A*

```
int A[] = {1,3,5,7};  
int n;  
n = A[0];
```

2. *Printing the second element of array B*

```
int B[] = {10,30,50,70};  
printf("%d", B[1]);
```

Getting values from elements

Examples:

3. Assigning the first element of array C with the value of the second element

```
int C[] = {11,23,35,47};  
C[0] = C[1];
```

4. Printing all elements of array D

```
int D[]={1,4,3,6,7,8,9,0,2};  
int i;  
  
for (i=0; i<9; i++)  
    printf("%d\n", D[i] );
```

Arrays and Functions

Passing an element of an array to a function can be in two forms:

- Pass by value - pass its content:
eg. `printf("%d", A[2]);`
- Pass by reference - pass its address:
eg. `scanf("%d", &A[2]);`

Arrays and Functions

Passing the whole array to a function can only be done by using **pass by reference**.

- It actually passes the address of the first element.

Example:

```
void increase(int x[3])
{
    x[0] += 1;
    x[1] += 2;
    x[2] += 3;
}

void main(void)
{
    int A[3]={10,20,30};
    increase(A); // or, increase(&A[0]);
}
```