Arrays

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Comp 230

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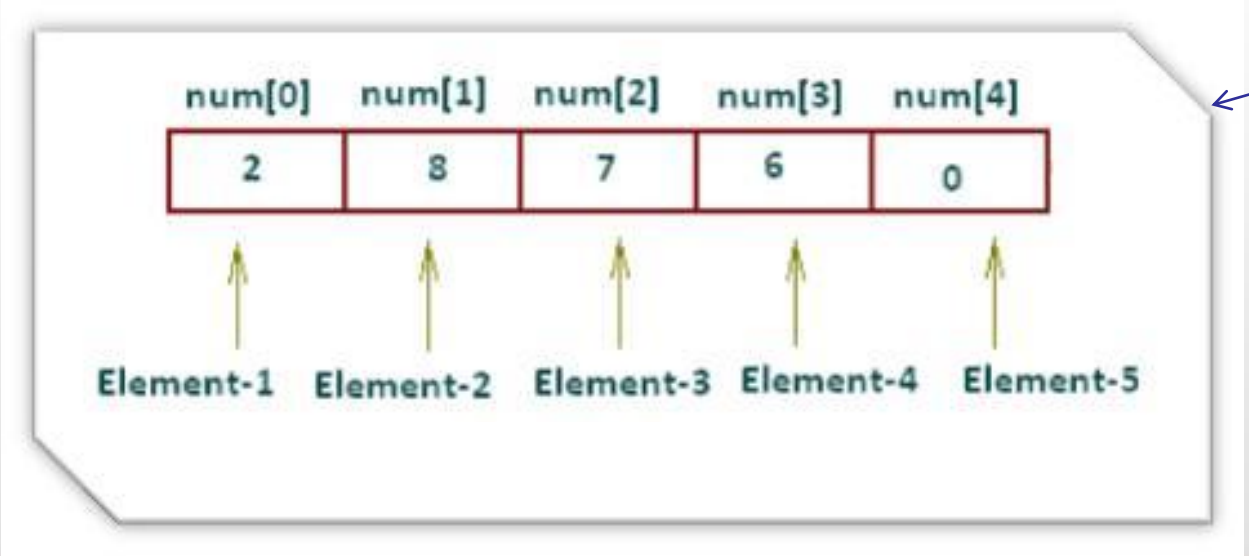
Arrays

Array is a collection of data items of the same type.

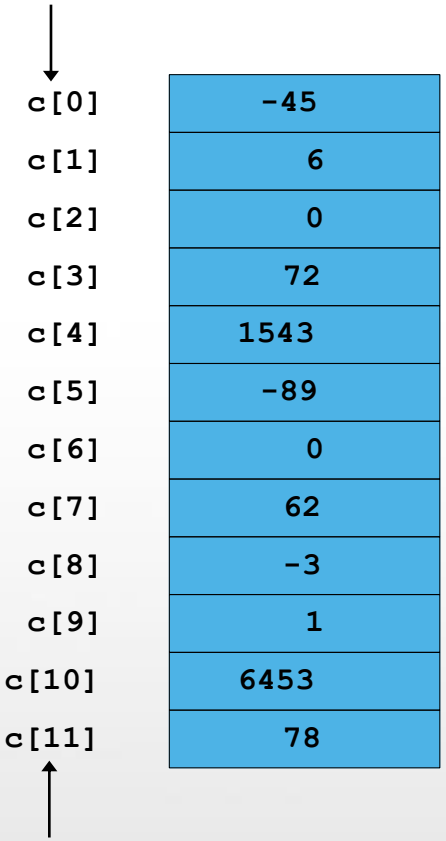
Array element is a data item that is part of an array.



Arrays

- Array
  - Group of consecutive memory locations
  - Same name and type
- To refer to an element, specify
  - Array name
  - Position number
- Format:

  arrayname [*position number*]
  - First element at position 0
  - n element array named c:
    - c[0], c[1]...c[n - 1]



Position number of the element within array c

Declaring Arrays

- When declaring arrays, specify

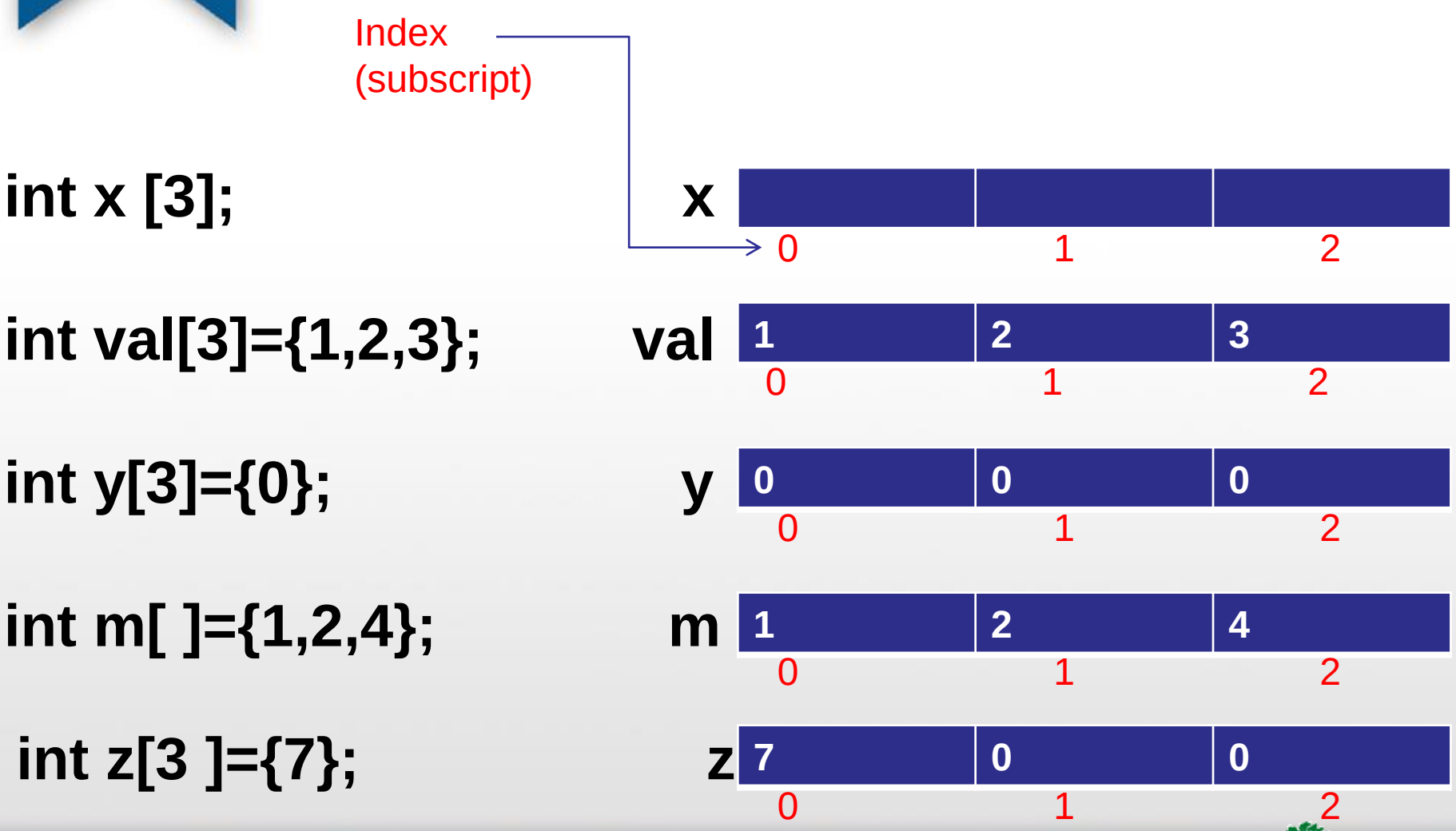
```
arrayType arrayName[numberOfElements ];
```

e.g.
```
int c[ 10 ];
float myArray[ 100 ];
```

- Declaring multiple arrays of same type
  - Format similar to regular variables

e.g.
```
int b[ 100 ], x[ 27 ];
```

Declaring Arrays



Arrays

Array elements are like normal variables

```
c[ 0 ] =  3;
printf( "%d", c[ 0 ] );
c[1]= c[0]+c[2]
c[3]= c[2]+5
```

Perform operations in subscript (index).

```
c[ 5 - 2 ] == c[ 3 ] == c[ x ]
```

Examples Using Arrays

- Initializers

```
int n[ 5 ] = { 1, 2, 3, 4, 5 };
char alphabet[5] = {'A','B','C','D','E'};
```

- All elements 0

```
int n[ 5 ] = { 0 }
```

- If size omitted, initializers determine it

```
int n[ ] = { 1, 2, 3, 4, 5 };
```

5 initializers, therefore 5 element array

Examples Using Arrays

```
int a [5] = {5,2,9,10,31};
int result = a[3%2] + a[2]+a[4/2];
printf("%d\n",result);
printf("%d",a[5%3]);
```

Output:

20

9

```
int a [5] = {5,2,9,10,31};
int temp;
printf("%d   %d",a[0], a[4]);
temp=a[0];
a[0]=a[4];
a[4]=temp;
printf("\n%d   %d",a[0], a[4]);
```

Output:

5 31

31 5

Example: Fill and Print Array

```c
#include <stdio.h>

int main ()
{
   int n[ 10 ];  // n is an array of 10 integers
   int i,j;

    // initialize elements of array n      (Fill Array)
   for ( i = 0; i < 10; i++ )
   {
      n[ i ] = i + 1; /* set element at location i to i + 1 */
   }

    // output each array element's value (Print Array)
   for (j = 0; j < 10; j++ )
   {
      printf("Element[%d] = %d\n", j, n[j] );
   }

   return 0;
}
```

Output:

```
Element[0] = 1
Element[1] = 2
Element[2] = 3
Element[3] = 4
Element[4] = 5
Element[5] = 6
Element[6] = 7
Element[7] = 8
Element[8] = 9
Element[9] = 10
```

Example: Fill and Print Array

```c
#include <stdio.h>
#define size 5 //   array size= 5
int main ()
{
   int n[ size ]; //  n is an array of 5 integers
   int i,j;

   //  initialize elements of array n (Fill Array)
   for ( i = 0; i < size; i++ )
   {
      scanf ("%d",&n[ i ]);
   }

   //  output each array element's value (Print Array)
   for (j = 0; j < size; j++ )
   {
      printf("Element[%d] = %d\n", j, n[j] );
   }

   return 0;
}
```

Input:

```
1 2 3 4 5
```

Output:

```
Element[0] = 1
Element[1] = 2
Element[2] = 3
Element[3] = 4
Element[4] = 5
```

Examples

Example 1 (Fill and print array using function)
Example 2 (Inverse Array using function)
Example 3 (sum two arrays)
Example 4 (sort array)

Example: Finding the Maximum

```c
#include <stdio.h>
#define size 5
int main()
{
    int i,max;
    int list[size];
    //initialize the array
    for (i=0;i<size;i++)
        scanf("%d",&list[i]);
    //find maximum value
    max=list[0];
    for (i=1;i<size;i++)
        if (max<list[i])
         max=list[i];
    printf("Maximum value:%d",max);
    return 0;
}
```

Example: sorting it in descending order

```
void Sort(int array[])
{
    int i,j;
    int temp;
    for(i=0;i<Size-1;i++)
    {
        for (j=i+1;j<Size;j++)
        {

            if (array[i]<array[j])
            {
                temp=array[j];
                array[j]=array[i];
                array[i]=temp;
            }
        }
    }
}
```

Code

Enter array of integers with size 3
3 4 5
array after sorted :5 4 3

Linear Search

Problem:
Given a list of N values, determine whether a given value X occurs in the list.

For example, consider the problem of determining whether the value 55 occurs in:

1	2	3	4	5	6	7	8
17	31	9	73	55	12	19	7

Solution:
start at one end of the list,
if the current element doesn't equal the search target, move to the next element, stopping when a match is found or the opposite end of the list is reached.

Code

Example

Write a program that takes 7 integers as input and prints the number with the smallest sum of digits and its location in the array.

Code

Creating a 2D Array

Create array elements by telling how many ROWS and COLUMNS

Example:

```
int grades[5][3];
```

grades is a two-dimensional array, with 5 rows and 3 columns.
One row for each student. One column for each test.

Example

```
int a[2][4];

a[1][0]=9;

a[0][3]=5;

a[0][1]=a[0][3]+ a[1][0];
```

	0	1	2	3
0		14		5
1	9			

Declare & Initialize

Example:

```
int grades[5][3] =
   { { 78, 83, 82 },
     { 90, 88, 94 },
     { 71, 73, 78 },
     { 97, 96, 95 },
     { 89, 93, 90 } };
```

A Two-D Array is an array of arrays.

Each row is itself a One-D array.

Row, Column Indices

	0	1	**2**
0	78	83	82
1	90	88	94
2	71	73	78
3	97	96	**95**
4	89	93	90

Give both the ROW and COLUMN indices to pick out an individual element.

The fourth student's third test score is at ROW 3, COLUMN 2

Example : Fill Array

What are the elements of the **array** table?

```
int table[3][4];
int x = 1;
for   (row = 0; row < 3; row++)
      for   (col = 0; col < 4; col++)
      {
            table[row][col] = x;
            x++;
      } //for col
```

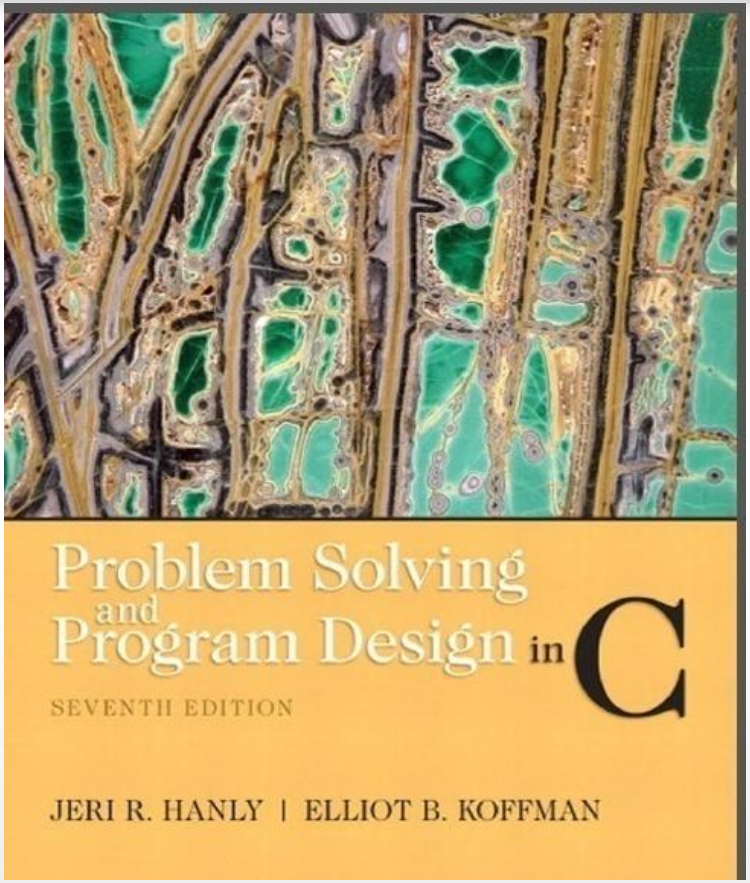
Example

Write a program that adds up two 2x2 arrays and stores the sum in third array.

Code

Question?

“Success is the sum of small efforts, repeated day in and day out.”
Robert Collier



References:

Problem Solving & Program Design in C (main reference)