

Lecture 2.1

Arrays

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What are arrays?

- Arrays are data structure.
- They are used to store a group of objects/ variables.
- All elements of an array must be of the **same** data type: *int*, *float*, *char*, *pointer to int*.
- The elements are stored **sequentially** in memory (this allows powerful manipulation with pointers).

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How to define an array?

- An array is defined with this syntax (the same syntax is used in C and C++):

```
datatype arrayName[size];
```

Examples:

```
int ID[30];
```

```
float temperatures[31];    /* Could be used to store the daily  
                           temperatures in a month */
```

```
char name[20];
```

```
int *ptrs[10]; /* An array holding 10 pointers to integer data */
```

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Using Arrays

- Array indexes starts from zero in C and C++.
- This means that an array of size N will be indexed from 0 to (N-1)

Example:

```
int myExample[3];
```

```
myExample[0] /* FIRST element */
```

```
myExample[1] /* SECOND element */
```

```
myExample[2] /* THIRD element */
```

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Sample program

- This sample program calculates and stores the squares of the first one hundred positive integers:

■ C++ program

```
#include <iostream.h>
#include <math.h>
#include <stdlib.h>

int main()
{
    int square[100];
    int i;

    for (i=0; i<100; i++){
        square[i] = (i+1)*(i+1);
        cout<<"Square of "<<i+1<<" is: "
            <<square[i]<<endl;
    }

    system("PAUSE");
    return 0;
}
```

C program

```
#include <stdio.h>
#include <math.h>
#include <stdlib.h>

int main()
{
    int square[100];
    int i;

    for (i=0; i<100; i++){
        square[i] = (i+1)*(i+1);
        printf("Square of %d is: %d\n",i+1,square[i]);
    }

    system("PAUSE");
    return 0;
}
```

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Common specifiers for C printf/scanf

Specifier	Argument Type
%d	int
%f	float or double
%e	float or double, output in scientific notation.
%c	Character
%s	character string (char *)

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How to initialize an array?

- An array can be initialized with an explicit **initialization list** in its definition.

Example:

- `int myArray[5]={6,7,888,987,0};`

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Practical Problem: recursive functions

- Arrays can be used to generate sequence of numbers where a term of sequence depends on next or previous term.

Example: fibonacci sequence, mathematical factorial etc.

- A Fibonacci sequence is a numerical sequence such that after the second element, all numbers are equal to the sum of the previous two elements. (1,1,2,3,5,8,13,21,...)
- Factorial of non negative integer n is the product of all positive integers less than or equal to n . (1,1, 2, 6, 24, ...)
- Write a program to calculate and print the first 20 elements of these sequences.

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