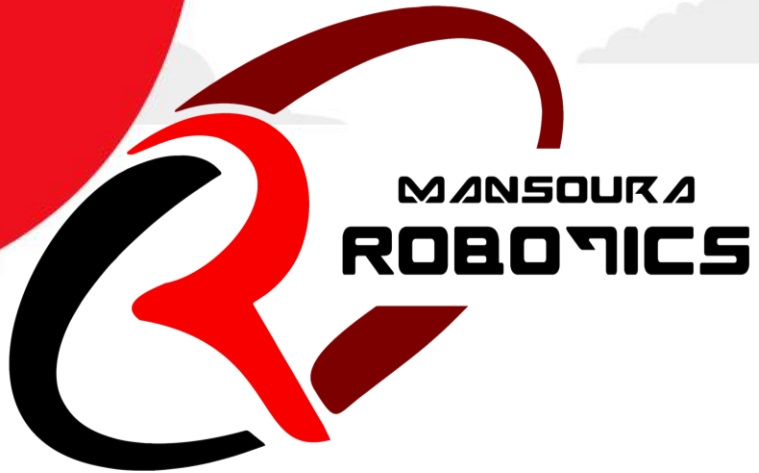
UCCD Arduino Course

Lecture 1



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Introduction to C Programming

02

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03

Printing and Scanning Values in C

04

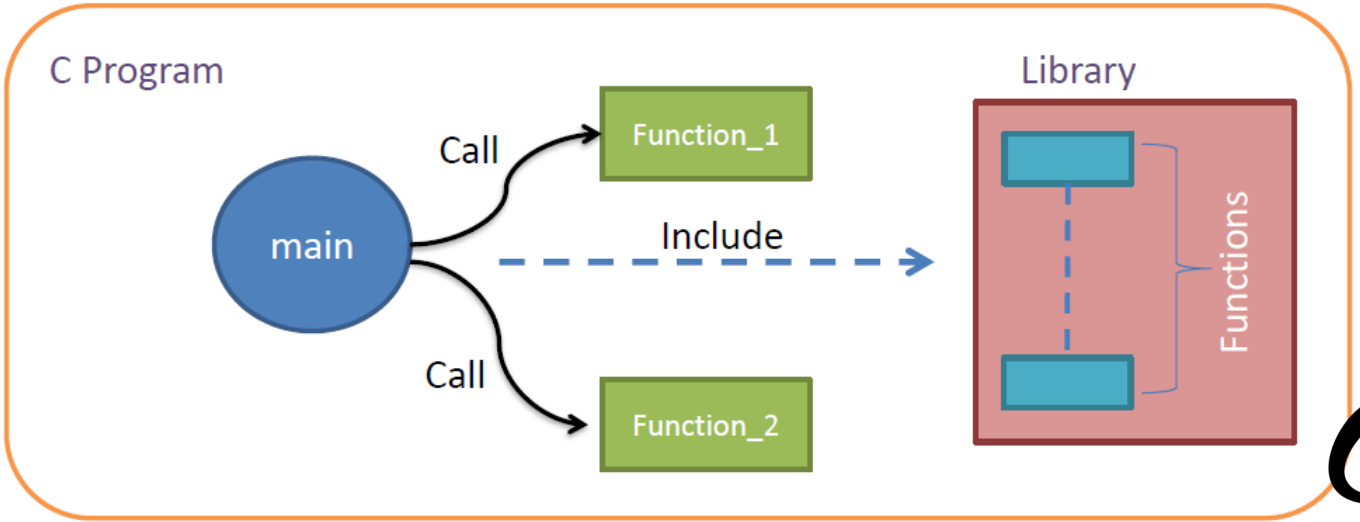
C Opterators

01

Introduction to C Programming

Toolchain definition

- C is structured programming, it means that the C program is composed of small parts each part called ***"function"***.
- The first function to be executed (The entry point of the program) is called ***"main"***.
- Sometimes, we may write some functions in a stand alone file for organizing, this file is called ***"library"***.



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Hello World in C

```c
/* Include stdio.h library
   To use printf function */
#include <stdio.h>

// define the main function
void main(void)
{
    /* Call the main function and
    pass string to it to print */
    printf("Hello C world");
}
```

Multiline comment

Include command

Single line comment

printf function call

Any line inside a function must ends with semicolon ;

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Comments in C

Comments are non-executable text used to provide documentation for the code. It provide clarity to the C source code allowing others to better understand what the code was intended to accomplish.

It is always recommended to use comments in your code, for that in IMT we have a rule, at least one comment for each code line.

1- Single-line comment

Any line preceded by two forward slashes **//**.

```
// This is single line comment
```

2- Multi-line comment

Any text starts with /* and ends with */

```
/* This is multiline comment */
```

Strings in C

- It is comprised of a set of characters that can also contain spaces, special characters and numbers.
- In C string is represented between double quotation *" This is string "*.
- *printf* function will print the string passed to it as it is.

- Escape operator may be used inside the string \ , this operator may insert tab, new line or quotes.

```
printf("My Name is Ahmed\n");
printf("I'm 26 Years Old  ");
```

\n	New line
\t	Horizontal tab
\v	Vertical tab
\'	Single quote
\"	Double quote

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LAB1

Write a C code that will print your short biography.

Full Name, Birth Year, Faculty, and graduation year

Time to Code

Expected Output

```
I'm Ahmed Assaf

My birth date is 22 Sep 1991

I graduated from Faculty of Engineering

Cairo University 2013
```

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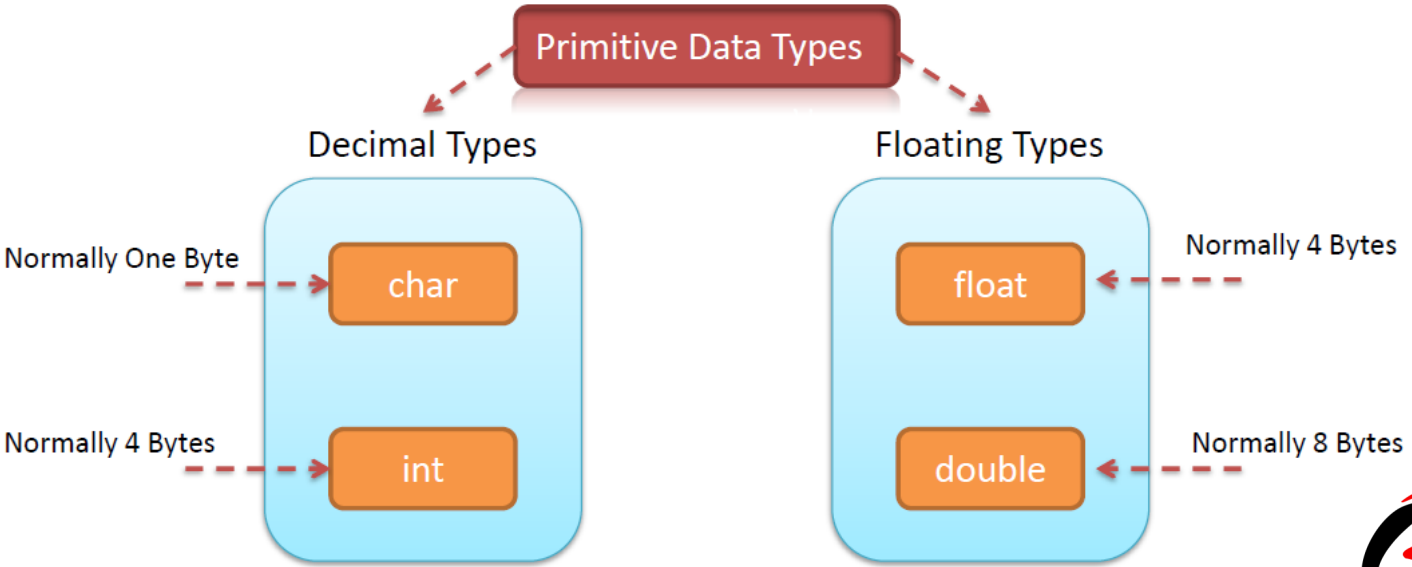
02

Variables in C

Variables in C

- Variable is a part from the memory, used to hold a piece of data.
- The variable has a *type*, *name* and *value*.
- The types of the variables differs in *Size* and/or *Data to be saved*.



Note, Data types size may differ from one compiler to other, this issue will be discussed later.

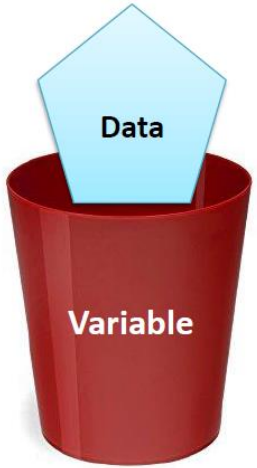
Variables in C

Syntax

```
type    name    ;
```

Or

```
type    name   = initial_value  ;
```




```
char x = 9;
int y;
float z = 6.52;
```

Define char variable and initialize it with 9

Define int variable with initialization, it will have a random value, called ***garbage***

Define float variable and initialize it with floating number

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Variables Naming rules

1- Variable can contain:

- Capital Letters A to Z
- Small Letters a to z
- Numbers 0 to 9
- Underscore _

2- First Character must be alphabet or Underscore

```
int a1;
```
Allowed

```
int 1a;
```
Not Allowed

3- Blanks & Commas are not allowed

4- No Special Symbols other than underscore are allowed, *ex ?, #, ... etc*

5- Variable name Should not be Reserved Word

6- Variable name can not be repeated in the same scope *"Will be clarified later"*

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Question

What will be the output of the following code … ?

```c
#include <stdio.h>

void main(void)
{
    /* Define int variable and initialze 10 */
    int x = 10;

    printf ("The variable value is x");


}
```

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Solution

```c
#include <stdio.h>

void main(void)
{
    /* Define int variable and initialze 10 */
    int x = 10;

    printf ("The variable value is x");


}
```

Output ---> `The variable value is x`

The string will be printed as it is, it will not replace *x* with its value. Instead it will deal with x as a normal character not a variable.

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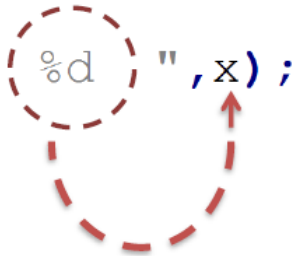
Printing and Scanning Values in C

Printing a Variable

- ***printf*** function can print a variable inside the string, it could be done by inserting format specifier that will be replaced by the values specified in subsequent additional arguments.

- Example

```
printf ("The variable value is %d ",x);
```



This format specifier will be replaced by the value of x

The output

```
The variable value is  10
```

Common specifiers used with ***printf*** function

%d	Format specifier for decimal value
%f	Format specifier for floating value
%c	Format specifier for character value

Scanning a Value

scanf function is a part from the ***stdio*** library, it is used to get value from the user and save it in a variable.

Syntax

This operator must be written and will be discussed later

scanf(“*formatSpecifier*” , &*VariableName*);

Example

```
/* Define a variable to save a value from user */
int x;

/* Get the value from the user */
scanf("%d",&x);
```

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LAB2

Write a C code that will ask the user to enter a value then print it.

Expected Output

```
Please Enter the value: 10
The value you entered is 10
```

Time to Code

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04

C operators

C operators

Arithmetic	Uni	++	--				
	Bi	+	-	*	/	%	
Bit wise	&	|	~	^	>>	<<	
Assignment	=	+=	-=	*=	/=	%=	+=
	&=	|=	^=	>>=	<<=		
Relational	>	<	>=	<=	==	!=	
Logical	&&	||	!				
Other	Size of operator	sizeof()					
	Ternary operator	? : ;					
	Address operator	& (will be discussed later)					
	Dereference	* (will be discussed later)					
	Subscriptor	[ ] (will be discussed later)					

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Arithmetic operators

Bi Operators, operators that takes two operands

```
int x = 10;

int y = 5 ;
```

1- Summation

example

```
int sum = x + y;    /* sum = 15   */
```

2- Subtraction

example

```
int sub = x - y;    /* sub = 10   */
```

3- Multiplication

example

```
int mul = x * y;    /* mul = 150 */
```

4- Division

example

```
int div = x / y;    /* div = 2    */
```

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Arithmetic operators

Bi Operators, operators that takes two operands

```
int x = 10;

int y = 5 ;
```

5- Modulus (reminder)

example

```
int mod = x % y;    /* mod = 0    */
```

example

```
int mod = y % x;    /* mod = 5    */
```

example

```
int mod = 10 % 3;   /* mod = 1    */
```

example

```
int mod = 9  % 1 ; /* mod = 0    */
```

example

```
int mod = 17 / 9;   /* mod = 8    */
```

LAB3

Write a C code that will ask the user to enter two values and print their summation and multiplication.

Expected Output

```
Please Enter number 1 : 10
Please Enter number 2 : 20
a + b = 30
a x b = 200
```

Time to Code

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Arithmetic operators

```
int x = 10;
```

Uni Operators, operators that takes one operand

1- Increment

example

```
x++;        /* x = 11 */
```

Postfix

example

```
++x;        /* x = 11 */
```

Prefix

2- Decrement

example

```
x--;        /* x = 9 */
```

Postfix

example

```
--x;        /* x = 9 */
```

Prefix

Note: In previous examples, no difference between postfix and prefix cases

Arithmetic operators

Uni Operators, operators that takes one operand

```
int x = 10;
int y;
```

1- Increment

example

```
y = x++;        /* x = 11, y = 10 */
```

Assign x to y, then increment x

example

```
y = ++x;        /* x = 11, y = 11 */
```

Increment x, then assign x to y

2- Decrement

example

```
y = x--;        /* x = 9 , y = 10 */
```

Assign x to y, then decrement x

example

```
y = --x;        /* x = 9 , y = 9  */
```

Decrement x, then assign x to y

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Bitwise Operators

To apply these operators correctly, let's first imagine these numbers in binary

```
int x = 10;
int y = 5 ;
```

x = 1010
y = 0101

1- And

example

```
int and = x & y;      /* and = 0 */
```

2- Or

example

```
int or  = x | y;      /* or = 15 */
```

3- Not

example

```
char not = ~x;   /* not = 11110101 in binary 245 decimal */
```

4- XOR

example

```
int xor = x ^ y;      /* xor = 15  */
```

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Bitwise Operators

To apply these operators correctly, let's first imaging these numbers in binary

x = 1010
y = 0101

```
int x = 10;
int y = 5 ;
```

6- Right shift

example

Variable to shift

Shifting steps

```
int Right_shift = x >> 2;       /* Right_shift  = 2 */
```

7- Left shift

example

```
int Left_shift =  y << 2;       /* Right_shift = 20 */
```

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Assignment Operators

1- Assign

example:

```
x = 20;    /* Assign 20 to x */
```

```
int x = 10;
```

2- Add and Assign

example:

```
x += 3;    /* Add 3 to x and assign the value to x, x = 13 */
```

3- Subtract and Assign

example:

```
x -= 4;    /* Sub 4 from x and assign the value to x, x = 6 */
```

4- Multiply and Assign

example:

```
x *= 5;    /* Multiply x by 5 and assign the value to x, x = 50 */
```

5- Divide and Assign

example:

```
x /= 2;    /* Divide x by 2 and assign the value to x, x = 5 */
```

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Assignment Operators

```
int x = 10;
```

6- Modulus and Assignment

example:

```
x %= 4;    /* Get the reminder of x divided by 4 and assign
              the value to x, x = 2                          */
```

7- And then Assign

example:

```
x &= 1;    /* Apply and operation between x and 1 and assign
              the value to x, x = 0                          */
```

8- Or then Assign

example:

```
x |= 15;   /* Apply or operation between x and 15 and assign
              the value to x, x = 15                         */
```

9- XOR then Assign

example:

```
x ^= 2;    /* Apply xor operation between x and 2 and assign
              the value to x, x = 8                          */
```

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Assignment Operators

```
int x = 10;
```

10- Shift right then Assign

example:

```
x >>= 1;  /* Apply right shift to x by 1 step and assign
             the value to x, x = 5                        */
```

11- Shift left then Assign

example:

```
x <<= 1;  /* Apply left shift to x by 1 step and assign
             the value to x, x = 20
```

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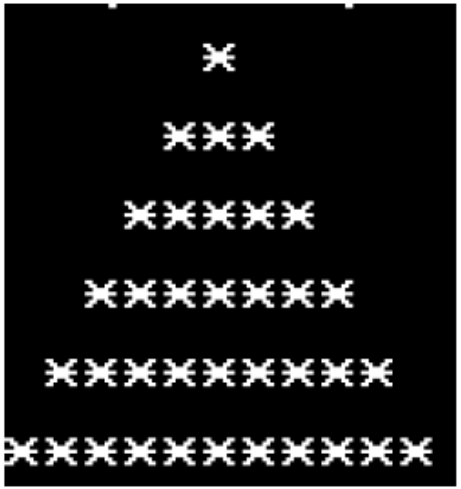
Thank you!

Do you have any questions?

Assignment 1

Write a code that can draw this pyramid



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Assignment 2

Write a code that scan 3 numbers from the user and print them in reversed order

```
Please enter number 1: 11
Please enter number 2: 12
Please enter number 3: 13
number 3: 13
number 2: 12
number 1: 11
```

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Assignment 3

Write a code that takes 2 numbers and print their summation, subtraction, anding, oring, and Xoring

```
Please Enter number a: 4
Pleae Enter number b:  2
a + b = 6
a - b = 2
a & b = 0
a | b = 6
a ^ b = 6
```

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