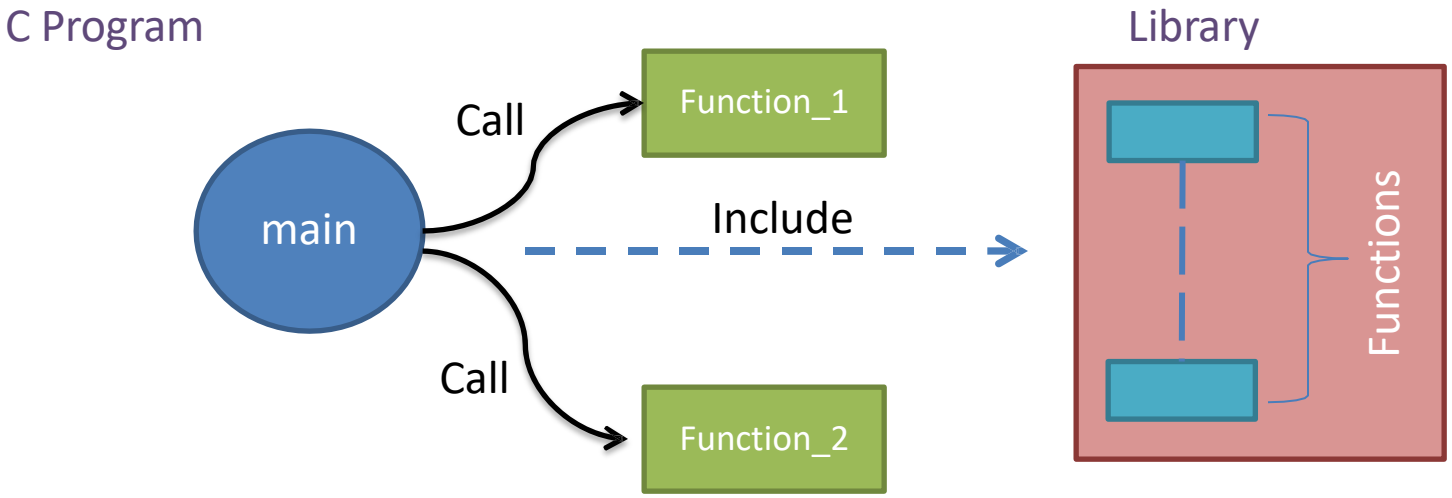
C Programming

C Programming Basics

Introduction To C Programming

- 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"***.



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 ;

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

LAB 1

Expected Output

Write a C code that will print your short biography.

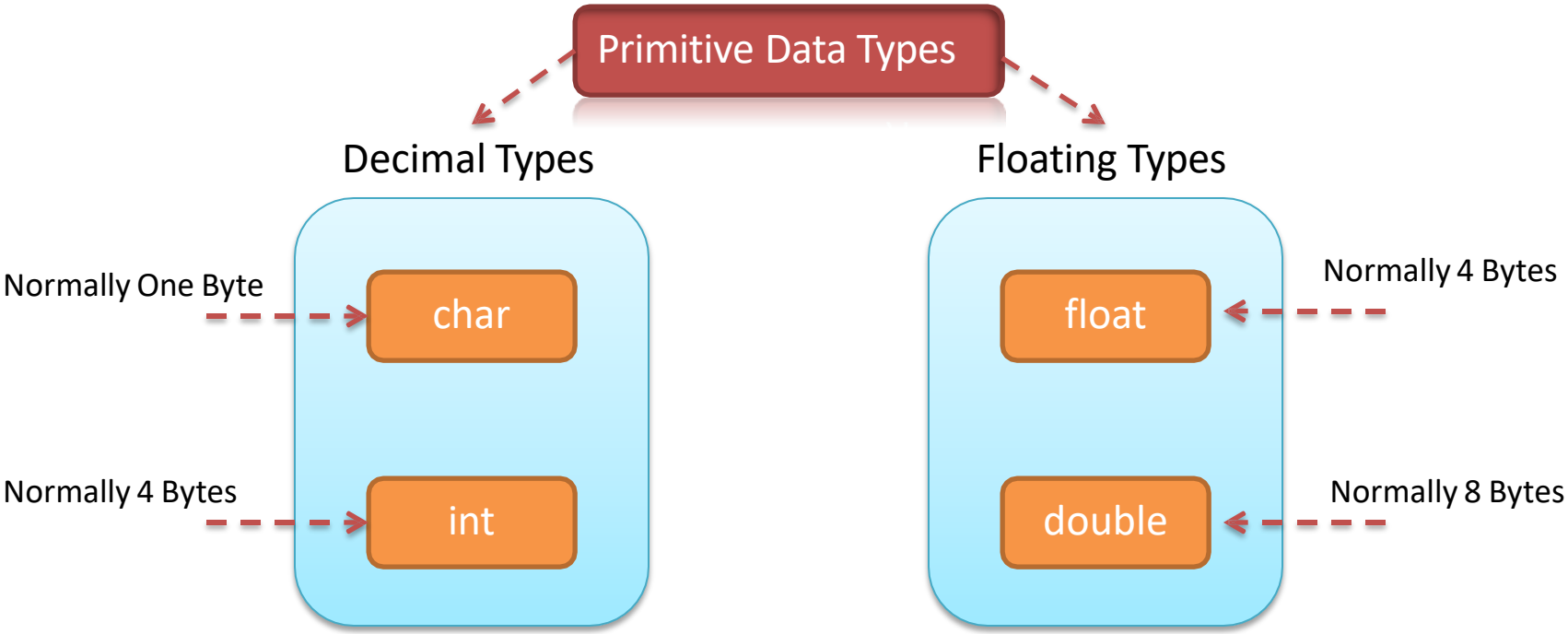
Full Name, Birth Year, Faculty, and graduation year

Time To

Code

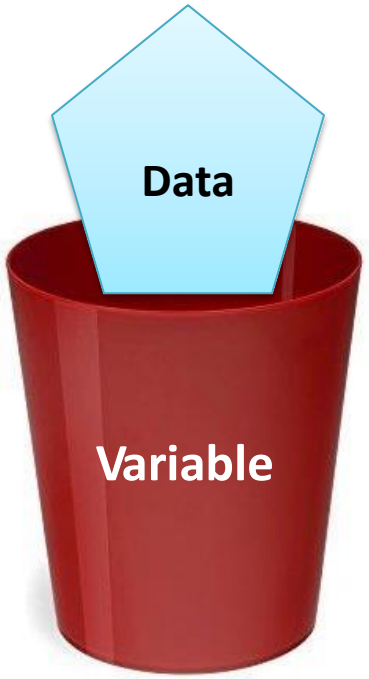
Variables in C

- 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

Variable 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"*

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");


}
```

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
```

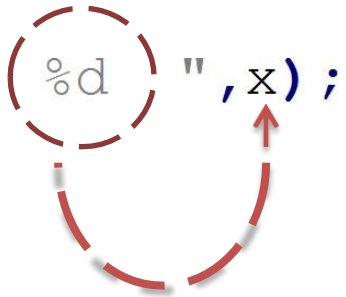
The string will be printed as it is, it will not replace *x* with its value. Instead it will deal with x as a normal character not a variable.

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);
```

LAB 2

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

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)					

Arithmetic Operators

```
int x = 10;

int y = 5 ;
```

Bi Operators, operators that takes two operands

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    */
```

Arithmetic Operators

```
int x = 10;

int y = 5 ;
```

Bi Operators, operators that takes two operands

5- <u>Modulus</u> (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    */
```

LAB 3

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

Arithmetic Operators

Uni Operators, operators that takes one operand

```
int x = 10;
```

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

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  */
```

Bitwise Operators

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

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

x = 1010
y = 0101

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 */
```

LAB 4

Solve these examples in a paper and confirm the that your answers are correct by writing a code printing the result

```
x = 7;
y = 4;
```

```
z = x & y;

k = x | y;

m = x ^ y;

L = x >> 1;

N = y << 2;
```

Time To Code

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 */
```

5Divide and Assign

example:

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

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                          */
```

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

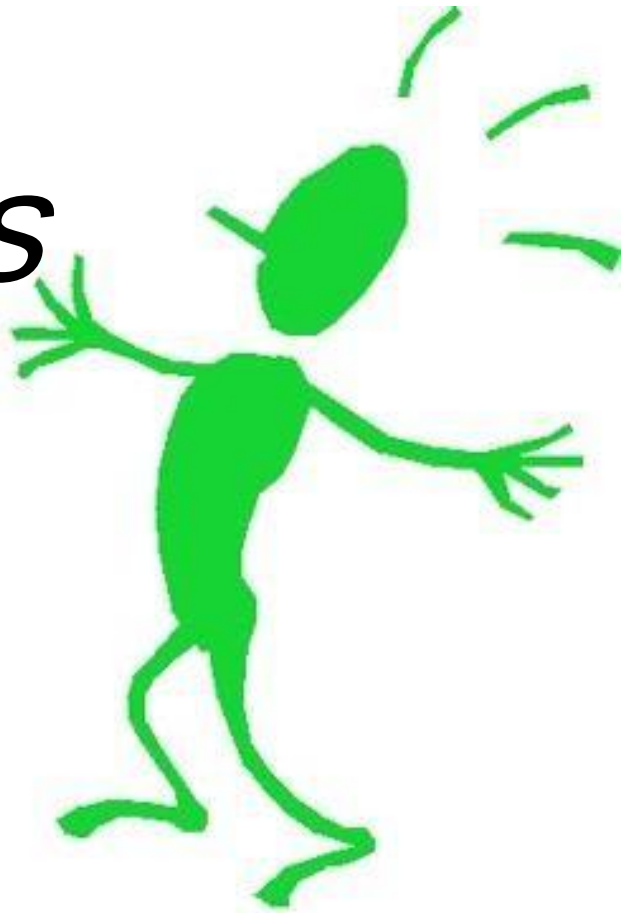
example:

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

The End …

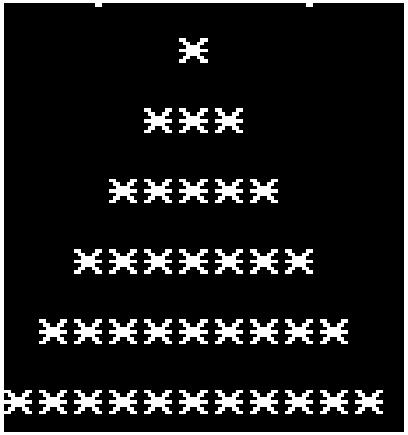
Other types of operators will be discussed later on, …..

Any questions … ?



Assignment 1

Write a code that can draw this pyramid



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
```

1- one dim array of int

->initialization by zero { 10 ,20,30 ,5 ,7}

->scan data

->print

➔ Sum

➔ Max

➔ Min

➔ Target :100 (search)

2- two dim array

➔ Initialization

➔ Scan data

➔ Print

➔ Sum of each row

➔ Average of each col

3- Magic box

4-@ home

1- factorial

2-revrese

Int x=2345;

```
#include <Windows.h>
#define null -32
void gotoxy(int x,int y)
 {
   COORD coord={0,0};
   coord.X=x;
   coord.Y=y;
   SetConsoleCursorPosition(GetStdHandle(STD_OUTPUT_HANDLE),coord);
 }
```