

CL1002 – Programming Fundamentals Lab



Lab # 03

Introduction to C Programming

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Programming

Programming is the process of creating a set of instructions that tell a computer how to perform a task.

Introducing C

C is a general-purpose programming language developed in 1972 by Dennis Ritchie.

C has been used to write everything from operating systems (including Windows and many others) to complex programs like the Python interpreter, Git, Oracle database, and more.

C programming is considered as the base for other programming languages, most of the compilers, Kernels, etc. are written in C language, and most of the programming languages follow C syntax, for example, C++, Java, C#, etc. That is why it is known as mother language.

GCC

GCC is a Linux-based C compiler released by the Free Software Foundation which is usually operated via the command line. It often comes distributed freely with a Linux installation, so if you are running UNIX or a Linux variant you will probably have it on your system. You can invoke GCC on a source code file simply by typing:-

```
gcc filename
```

The default executable output of GCC is "a.out", which can be run by typing
“ ./a.out ”. It is also possible to specify a name for the executable file at the command line by using the syntax “ -o outputfile” , as shown in the following example : -

```
gcc filename -o outputfile
```

Again, you can run your program with "./outputfile". (The ./ is there to ensure you run the program for the current working directory.)

Beginning with C programming:

```
#include <stdio.h>
int main()
{
    printf("Hello World");
    return 0;
}
```

Structure of a C program

We can formally assess the structure of a C program. By structure, it is meant that any program can be written in this structure only. Writing a C program in any other structure will hence lead to a Compilation Error.

The structure of a C program is as follows:

Structure of C Program	
<i>Header</i>	<code>#include <stdio.h></code>
<i>main()</i>	<code>int main() {</code>
<i>Variable declaration</i>	<code>int a = 10;</code>
<i>Body</i>	<code>printf("%d ", a);</code>
<i>Return</i>	<code>return 0; }</code>

The components of the above structure are:

#include <stdio.h> includes the standard input output library functions. The `printf()` function is defined in `stdio.h` .

int main() The `main()` function is the entry point of every program in c language.

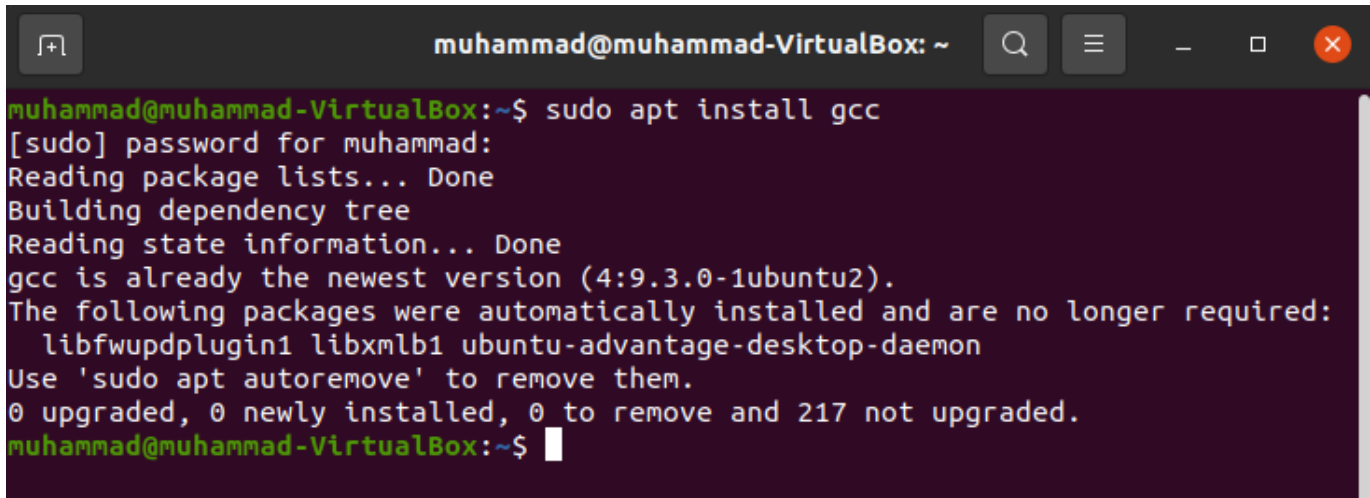
printf() The `printf()` function is used to print data on the console.

return 0 The `return 0` statement, returns execution status to the OS. The 0 value is used for successful execution.

Task: A Simple First Program

You need to perform the following to complete the task.

1. Open the Terminal (Ctrl + Alt + t)
2. Installation gcc

A terminal window titled 'muhammad@muhammad-VirtualBox: ~' with standard window controls. The terminal output shows the command 'sudo apt install gcc' being executed. It reports that gcc is already the newest version (4:9.3.0-1ubuntu2) and lists several packages that were automatically installed and are no longer required: libfwupdplugin1, libxmlb1, and ubuntu-advantage-desktop-daemon. It suggests using 'sudo apt autoremove' to remove them. The final status is '0 upgraded, 0 newly installed, 0 to remove and 217 not upgraded.'

```
muhammad@muhammad-VirtualBox:~$ sudo apt install gcc
[sudo] password for muhammad:
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc is already the newest version (4:9.3.0-1ubuntu2).
The following packages were automatically installed and are no longer required:
  libfwupdplugin1 libxmlb1 ubuntu-advantage-desktop-daemon
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 217 not upgraded.
muhammad@muhammad-VirtualBox:~$
```

Note: gcc is already installed on lab PCs

3. Create file of .c file extension using touch command

```
~$ touch helloworld.c
```

4. Now open the text editor using gedit command

```
~$ gedit helloworld.c
```

5. Write the following code in helloworld.c file.

```
#include <stdio.h>
int main()
{
    printf("Hello World");
    return 0;
}
```

6. Save and close the file.
7. compile and execute it

```
~$ gcc helloworld.c -o helloworld.out
```

~\$./helloworld.out

printf() and scanf() in C

The printf() and scanf() functions are used for input and output in C language. Both functions are inbuilt library functions, defined in stdio.h (header file).

printf() function

The printf() function is used for output. It prints the given statement to the console.

The syntax of printf() function is given below:

```
printf("format string",argument_list);
```

The format string can be %d (integer), %c (character), %s (string), %f (float) etc.

scanf() function

The scanf() function is used for input. It reads the input data from the console.

```
scanf("format string",argument_list);
```

Variables in C

- A named memory location where data is stored is called variable.
- A quantity whose value may change during execution of the program is called variable. It is represented by a symbol or name.
- Variable is the name of reserved area allocated in memory. In other words, it is a name of memory location.
- It is a combination of "vary + able" that means its value can be changed.

```
int data=10 // Here data is variable
```

Let's see the syntax to declare a variable:

```
type variable_list;
```

The example of declaring the variable is given below:

```
int a;  
float b;  
char c;
```

Here, a, b, c are variables. The int, float, char are the data types.

We can also provide values while declaring the variables as given below:

```
int a=10,b=20; //declaring 2 variable of integer type  
float f=20.8;  
char c='A';
```

Rules for defining variables

- A variable can have alphabets, digits, and underscore.
- A variable name can start with the alphabet, and underscore only. It can't start with a digit.
- No whitespace is allowed within the variable name.
- A variable name must not be any reserved word or keyword, e.g. int, float, etc.

Valid variable names:

```
int a;  
int _ab;  
int a30;
```

Invalid variable names:

```
int 2;  
int a b;  
int long;
```

Program to print cube of given number

Let's see a simple example of c language that gets input from the user and prints the cube of the given number.

```
1#include<stdio.h>
2int main(){
3
4  int number;
5  printf("enter a number:");
6  scanf("%d",&number);
7  printf("cube of number is:%d ",number*number*number);
8
9  return 0;
10 }
```

Output

A screenshot of a terminal window with a dark background. The window title is "muhammad@muhammad-VirtualBox: ~/Desktop/fundamental". The terminal shows the following commands and output:
muhammad@muhammad-VirtualBox:~/Desktop/fundamental\$ gcc task1.c -o task1.out
muhammad@muhammad-VirtualBox:~/Desktop/fundamental\$./task1.out
enter a number:3
cube of number is:27 muhammad@muhammad-VirtualBox:~/Desktop/fundamental\$

The **scanf("%d",&number)** statement reads integer number from the console and stores the given value in number variable.

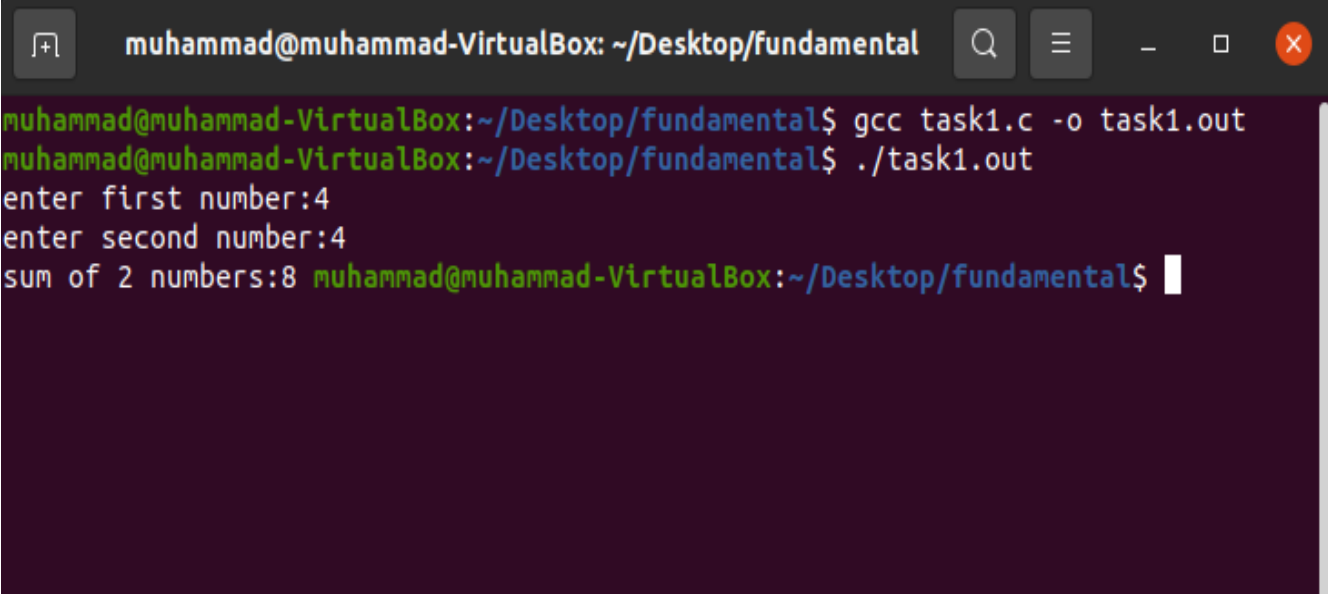
The **printf("cube of number is:%d ",number*number*number)** statement prints the cube of number on the console.

Program to print sum of 2 numbers

Let's see a simple example of input and output in C language that prints addition of 2 numbers.

```
1 #include<stdio.h>
2 int main(){
3
4 int x=0,y=0,result=0;
5
6 printf("enter first number:");
7 scanf("%d",&x);
8 printf("enter second number:");
9 scanf("%d",&y);
10
11 result=x+y;
12 printf("sum of 2 numbers:%d ",result);
13
14 return 0;
15 }
```

Output



A terminal window titled "muhammad@muhammad-VirtualBox: ~/Desktop/fundamental" shows the compilation and execution of a C program. The user enters the command `gcc task1.c -o task1.out` to compile the program, followed by `./task1.out` to run it. The program prompts for two numbers: "enter first number:" and "enter second number:". The user enters "4" for both. The program then outputs "sum of 2 numbers:8" followed by a new line and the prompt "muhammad@muhammad-VirtualBox:~/Desktop/fundamental\$".

```
muhammad@muhammad-VirtualBox:~/Desktop/fundamental$ gcc task1.c -o task1.out
muhammad@muhammad-VirtualBox:~/Desktop/fundamental$ ./task1.out
enter first number:4
enter second number:4
sum of 2 numbers:8 muhammad@muhammad-VirtualBox:~/Desktop/fundamental$
```


Exercises:

1. Write a C program that reads three values from user and find the sum and average of three numbers.
2. Write a C program that reads the mass of an object in kilograms and converts it to grams.
3. Design a C program that prompts the user to input the mass (m) in kilograms and the acceleration (a) in meters per second squared. Then, compute and display the resulting force (F) in Newtons using the formula $F = ma$.

References

<https://www.geeksforgeeks.org/c-language-set-1-introduction/>

<https://www.javatpoint.com/first-c-program>