C Programming

Why Learn C?

- C is most commonly used programming language for writing Operating System.
- UNIX was the first operating system written in C. Later Microsoft Windows, Mac OS and GNU/ Linux were all written in C.

Definition:

The C Programming Language is standardized programming language developed in the early 1972s by Ken Thompson and Dennis Ritchie for use on the UNIX Operating System.

C is prized for its efficiency and is most popular programming language for writing System Software, though it is also used for writing applications.

Facts about C

- C was invented to write an operating system called UNIX.
- C is a successor of B language, which was introduced around 1970.
- The UNIX OS was totally written in C by 1973.
- Today, C is the most widely used and popular System Programming Language.
- Most of the state-of-the-art software's have been implemented using C.
- Today's most popular Linux OS and RBDMS My SQL have been written in C.

Simple Program

```
#include <stdio.h>  //pre-processor directive
int main()       // main() function
{
    printf("Welcome in the world of C Programming");
}
```

```
C:\Program Files\Dev-Cpp\Console
Welcome in the world of C Programming
--------------------------------
Process exited with return value 0
Press any key to continue . . .
```

Line 1 : the #include is a "pre-processor" directive that tell the compiler to put code from the header file stdio.h (**Standard Input Output Header File**) and add the contents of that file to this program. By including header files, we can gain access to many different functions (i.e. printf() function).

Line 2 : this line tells the compiler that there is a function named main (every full c program begins inside a function called "main") and that the function returns integer value. The "curly braces" (**{** and **}**) signal the **beginning** and **end** of the functions and other code blocks.

A **Function** is simply a collection of commands that do "something". The main() function is always called when the program first executes.

Line 4 : the printf() function is the standard C way to displaying output on the screen.

Save above program as a **filename.c** file and compile it

Compiling Program:

Compilation is basically **translation**. A Computer Program called the compiler takes out C Source Code and translates it into the **Binary Language** use by computers.

Comments:

Comments are added to make a program more readable to you but the compiler must ignore the comments.

1. Single Line Comment
   // this is single line comment
2. Multi Line Comment
   /* this is
   Multi Line
   Comment
   */

One More Example:

```
#include <stdio.h>
int main()
{
	printf("This is a line of text to output.\n");		//	\n for new line
	printf("And this is another");
	printf("line of text.\n\n");
	printf("This is third line.");
}
```

Variable:

Before we try to receive input, we must have a place to store that input. In programming, input and data are stored in **variables**. There are several different types of variables; when we declaring a variable, we must include the **data type** along with the name of the variable. Several basic types include char, int and float. Each type can store different types of data.

A variable of type **char** stores a single character, variables of type **int** store integers (numbers without decimal places) and variable of type **float** store numbers with decimal places.

Definition:

Variable is a named memory location which can store a value.

A variable name in C can be anything from a single letter to a word. The name of a variable must begin with an alphabetic letter or the underscore (_) character which can be further followed by the following -

1. a……z (any letter from a to z)
2. A……Z (any letter from A to Z)
3. 0……9 (any digit from 0 to 9)
4. _ (underscore character)

Syntax: to declare a variable you use the syntax

```
Datatype  VariableName;
```

Data Type:

Data Type	Size	Range
char	1 Byte	-128 to 127
int	2 Byte	-32768 to 32767
long	4 Byte	-2,147,483,648 to 2,147,438,647
float	4 Byte	3.4e-38 to 3.4e+38
double	8 Byte	

For example:

```
int a, b;
a = 32766;    // correct
b = 40000;    // Incorrect, because a integer data type can store -32768 to 32767
```

Example 1:

```
int number;
```

Data Type Variable Name

Example 2:

```
int number;
number = 400;
```

Example 3:

```
int a, b, c
a = 10;
b = 30;
c = 540;
```

Example 4:

```
int x, y;
x = 10;
y = x;          // we can also assign the value of another variable.
```

We can have multiple variables of the same type, but we can't have multiple variables with the same name. Moreover, we can't have variables and functions with the same name.

A Final restriction on variables is that variable declarations must come before other types of statements. So in C, we must declare all the variables before do anything else:

Wrong

```
#include <stdio.h>
int main()
{
        /* wrong! The variable declaration must appear first */
        printf("Declare x next");
        int x;
}
```

Correct

```
#include <stdio.h>
int main()
{
	int x;
	printf("Declare x next");
}
```

The Most Commonly Needed Conversion specifiers:-

Specifier	Meaning	Types Converted
%c	Single Character	Char
%d	Integer	int
%f	Floating point number	Float, double

Reading Input

We'll be using the scanf() function to read in a value. Let's look at the program

```
#include <stdio.h>
int main()
{
	int value;
	printf("Enter Number ");
	scanf("%d", &value);
	printf("You Entered %d", value);
}
```

We have seen the #include and main() function before; main must appear in every program, and the #include gives us access to printf (as well as scanf).

We have a string containing %d – this tells the scanf() function to **read in an integer**. The second argument of scanf() is the variable. Using **&** in front of a variable allows you to get its location and give that to scanf instead to the value of the variable.

Read character

```
#include <stdio.h>
int main()
{
	int ch;
	printf("Enter any Character :  ");
	scanf("%c", &ch);
	printf("You Entered %c", ch);
}
```

Operators

1. **Arithmetic Operators**

+	Addition Operator
-	Subtraction Operator
*	Multiplication Operator
/	Division Operator

2. **Assignment Operator**(=)
3. **Relational Operators**

>	Greater than Operator
<	Less than Operator
>=	Greater than or Equals to Operator
<=	Less than or Equals to Operator
==	Equals to Operator

Addition Operator (+)

Example 1

```
#include <stdio.h>          //Standard input output header file
int main()
{
        int x, y, sum;
        x = 10;
        y = 450;
        sum = x + y;
        printf("Sum = %d", sum);
}
```

Example 2

```
#include <stdio.h>          //Standard input output header file
int main()
{
        int x, y, z, sum;
        printf("Enter First No ");
        scanf("%d", & x);
        printf("Enter Second No ");
        scanf("%d", & y);
        printf("Enter Third No ");
        scanf("%d", &z);
        sum = x + y + z;
        printf("Sum = %d", sum);

}
```

Multiplication Operator (*)

Example 1

```
#include <stdio.h>          //Standard input output header file
int main()
{
        int x, y, result;
        x = 10;
        y = 4;
        result = x * y;
        printf("Multiplication = %d", result);
}
```

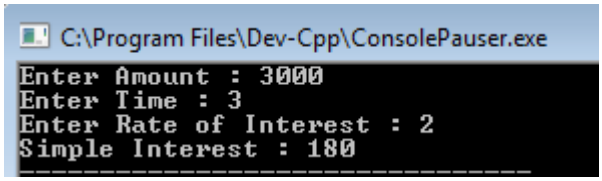
Q. Write a C Program to calculate simple interest.

```
#include<stdio.h>
int main()
{
        int amt, tm, rate, si;

        printf("Enter Amount : ");
        scanf("%d", &amt);
        printf("Enter Time : ");
        scanf("%d", &tm);
        printf("Enter Rate of Interest : ");
        scanf("%d", &rate);

        si = (amt*tm*rate)/100;

        printf("\nSimple Interest : %d", si);
}
```



Decision Control Statements

1. **If Statement**
    a. **If Statement**
    b. **If ... Else Statement**
    c. **If ... Elseif…Else Statement**
2. **Switch Statement**

If Statement

The structure of an If statement is as follow:

```
If (<condition>)
{
        //statements
}
```

Example

```
#include <stdio.h>

int main()
{
        int i;
        i = 22;
        if (i>=0)
        {
                printf("No is Positive");
        }
}
```

If Else Statement

The structure of an If statement is as follow:

```
If (<condition>)
{
        //statements
}
Else
{
        //statements
}
```

Example 1

```
#include <stdio.h>
int main()
{
	int i;
	i = 22;
	if (i>=0)
	{
		printf("No is Positive");
	}
	else
	{
		printf("No is Negative");
	}
}
```

Example 2(Write a program to check whether a given number is ever or odd.)

```
#include <stdio.h>
int main()
{
	int no;
	no = 10;
	if (no % 2 = = 0)
	{
		printf("No is Even");
	}
	else
	{
		printf("No is Odd");
	}
}
```

Example 3(Write a program to find greatest of two numbers.)

```
#include <stdio.h>
int main()
{
	int a, b;
	a = 100;
	b = 230;
	if (a > b)
	{
		printf("a is greater");
	}
	else
	{
		printf("b is greater");
	}
}
```

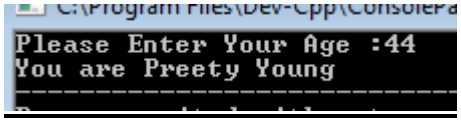
If Else If Statement

The structure of an If statement is as follow:

```
If (<condition>)
{
        //statements
}
Else if (<condition>)
{
        //statements
}
Else
{
        //statements
}
```

Example 1

```
#include <stdio.h>
int main()
{
        int age;
        printf ("Please Enter Your Age :");
        scanf("%d", &age);
        if (age<100)
        {
                printf("You are Preety Young");
        }
        else if (age == 100)
        {
                printf("You are Old");
        }
        else
        {
                printf("You are really old");
        }
}
```



Example 2(Write a program to Find greatest of two numbers.)

```
#include <stdio.h>
int main()
{
	int x, y;
	x = 100;
	y = 234;
	if (x > y)
	{
		printf("X is Greater");
	}
	else if (y > x)
	{
		printf("Y is Greater");
	}
	else
	{
		printf("X and Y are Equal");
	}
}
```

```
Y is Greater
----------------
```

Example 3

```
#include <stdio.h>
int main()
{
	int percent;
	percent = 67;
	if (percent>= 60)
	{
		printf("First Division");
	}
	else if (percent>=45)
	{
		printf("Second Division");
	}
	else if (percent>=33)
	{
		printf("Third Division");
	}
	else
	{
		printf("Fail");
	}
}
```

```
First Division
---------------
```

Switch Statement

The structure of a Switch statement is as follow:

```
switch (variable>)
{
        case this-value :
                //code
                break;
        case this-value :
                //code
                break;
        default :
                //code
}
```

Example 1

```
#include <stdio.h>
int main()
{
        int wdn;
        wdn = 3;
        switch (wdn)
        {
                case 1 :
                        printf("Monday");
                        break;
                case 2 :
                        printf("Tuesday");
                        break;
                case 3 :
                        printf("Wednesday");
                        break;
                case 4 :
                        printf("Thursday");
                        break;
                case 5 :
                        printf("Friday");
                        break;
                case 6 :
                        printf("Saturday");
                        break;
                case 7 :
                        printf("Sunday");
                        break;
                default :
                        printf("Wrong Input");
        }
}
```

Looping Statements

- Loops are used to repeat a block of code.
- There are three types of loops: While, Do – While and For loop.

1. **While Loop**
2. **Do While Loop**
3. **For Loop**

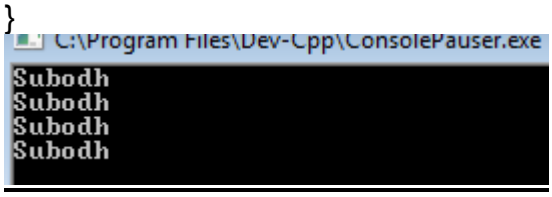
While Loop

The basic Structure is

```
while (condition)
{
        // code to execute while the condition is true
}
```

Example 1:

```
#include <stdio.h>
int main()
{
        int x = 1;
        while (x <= 4)
        {
                printf("Subodh\n");
                x = x + 1;
        }
}
```



Example 2:

```
#include <stdio.h>
int main()
{
        int x = 1;
        while (x <= 4)
        {
                printf("%d", x);
                x = x + 1;
        }
}
```

Do While Loop

Do – While loop are useful for things that want to loop at least once. The Structure is -

```
Do
{
        // code
}
while (condition);
```

Example 1:

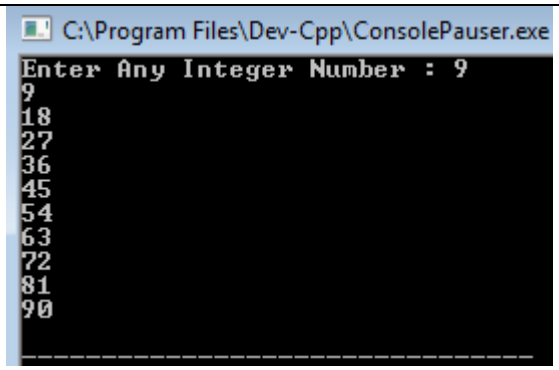
```
#include <stdio.h>
int main()
{
        int x = 1;
        do
        {
                printf("Subodh\n");
                x = x + 1;
        }
        while (x <= 4);
}
```

Example 2:

```
#include <stdio.h>
int main()
{
        int x = 1;
        do
        {
                printf("%d", x);
                x = x + 1;
        }
        while (x <= 4);
}
```

Example 3:

```
#include <stdio.h>
int main()
{
        int x, no;
        x = 1;
        printf("Enter Any Integer Number : ");
        scanf("%d", &no);
        do
        {
                printf("%d\n", x*no);
                x = x + 1;
        }
        while (x <= 10);
}
```



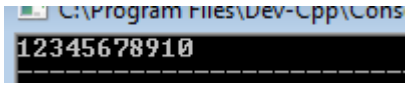
For Loop

For Loop is the most useful type. The syntax for a For Loop is

```
for (variable-initialization; condition; increment/decrement)
{
        //code
}
```

Example 1

```
#include <stdio.h>
int main()
{
        int x;
        for (x = 1; x <= 10; x++)
        {
                printf("%d", x);
        }
}
```



Example 2

```
#include <stdio.h>
int main()
{
        int x;
        for (x = 5; x >= 1; x--)
        {
                printf("%d", x);
        }
}
```