# Lab 1: Introductory concepts

**Objective: The main objectives of this lab are to:**

- **Learn about the environment of the tools to be used to write C code.**
- **Learn how to write a simple C code and save it in specific directory.**
- **Learn How to compile and run a C code.**
- **Learn how to detect an error or warning and solve it.**
- **Know the file types (.c,.obj,.exe) created by the user and compiler .**

**Write your first program to print "Hello World".**

**Sample Code:**

```
#include<stdio.h>          /* Header File */
int main(){                /*Start of main function*/
printf("Hello World");     /*Display output*/
return 0;
        }                  /*end of main function*/
```

**Purpose of header files:** Header files keep the function declaration separate from function definition. Programs often need to use functions "defined" elsewhere... inside other .c/.cpp files or inside binary .obj files. Using the header files, one can "compile" programs without needing the function definition.

**List of some common header files**

**<ctype.h>:**Defines set of functions used to classify characters by their types or to convert between upper and lower case in a way that is independent of the used character set.

**<math.h>:** Defines common mathematical functions.

**<stdio.h>:** Defines core input and output functions.

**<stdlib.h>:** Defines numeric conversion functions, pseudo-random numbers generation functions, memory allocation, process control functions.

**<string.h>:** Defines string handling functions.

**<time.h>:** Defines date and time handling functions.

## Practice 1

- **Write a program to display the following output:**

```
My name is XX.
I have come from YY.
I am a student of ZZ department.
```

**Sample Code:**

```
#include<stdio.h>

 int main() {
printf("My name is XX.\nI have come from YY.\nI am a student of ZZ department.");
return 0;
        }
```

## Do It Yourself

- **Write a program to display the following output using the above concept:**

```
*
* *
* * *
* * * *
```

**scanf function:** The scanf () function scans and formats input from stdin (standard input device) which is within the header file: <stdio.h> . It scans a series of input fields (all characters up to the next white-space character) one character at a time.

The format of scanf() function is:

**scanf ("Formatted _specifier", & variable_ name);**

If you don't use the & (Address Operator), you might get undesired result. So you should be careful to put it before variable name. A list of formatted specifier is given below→

| Formatted specifier | Meaning |
|---|---|
| %d | For taking integer value |
| %c | For taking a character |
| %s | For taking string |
| %f | For taking float and double value |

## Practice 2

- **Write a program that can read an integer number from keyboard and display it.**

**Sample Code:**

```
#include<stdio.h>

 main() {
 int n;
 printf(“waiting for an integer:\n”);
 scanf(“%d”,&n);
 printf(“the value is: %d\n”,n);
            }
```

**Sample Output:**

```
Waiting for an integer:
10

the value is: 10
```

## Do It Yourself

- **Write a program that can read a floating point number from keyboard and display it.**

## Practice 3

- **Write a program for calculating the area of a circle.**

**Sample Code:**

```
#include<stdio.h>

 int main() {
 float radius, area;
 printf("\nEnter the radius of a circle : ");
 scanf("%f", &radius);

 area = 3.14 * radius * radius;
 printf("\nArea of Circle : %.2f", area);
 return 0;
              }
```

**Sample Output:**

```
Enter the radius of a circle: 2.0

Area of Circle: 12.56
```

## Do It Yourself

- **Calculate the area of a rectangle through C code using the above concept.**

## Practice 4

- **Write a program that takes two integers as input from keyboard, adds them and display the result.**

**Sample Code:**

```
#include<stdio.h>

int main() {
int a,b,c;
printf("Waiting for two integers a & b:\n");
scanf("%d %d",&a,&b);
c=a+b;
printf(" The result is:%d",c);
return 0;
        }
```

**Sample Output:**

Waiting for two integers a & b:
10 20
The result is: 30

## Do It Yourself

- **Write a program that takes two real numbers as input from keyboard, adds them and display the result.**

**Exercises**

- **Suppose, I=10 amp, R=4 ohm. Write a code using C language to calculate the voltage for these given values. Also try to calculate the output voltage value by taking user inputs from keyboard.**

- **Write a C code for temperature conversion from Fahrenheit to Celsius using the formula: c=f-32*5/9 .**

- **Take four integer values as inputs from keyboard, calculate their average and display the result.**

# Lab 2: Operators and Expressions

**Objective: The main objectives of this lab are to:**

- **gain knowledge about different types of operators.**
- **Practice operations of these operators.**
- **Gather knowledge to evaluate expressions.**

**Practice 1**

**Write your first program to demonstrate the working of arithmetic operators in C.**

**Sample Code**

```
#include <stdio.h>

int main(){

int a=9,b=4,c;

c=a+b;

printf("a+b=%d\n",c);

c=a-b;

printf("a-b=%d\n",c);

c=a*b;

printf("a*b=%d\n",c);

c=a/b;

printf("a/b=%d\n",c);

c=a%b;

printf("Remainder when a divided by b=%d\n",c);

return 0; }
```

## Do it yourself

**Write a program to convert a given number of days into months and days.**

**The sizeof operator:** It is a unary operator which is used in finding the size of data type, constant, arrays, structure etc.

**Practice 2**

**Write a program to find size of integer, float, double and character of your system.**

**Sample code:**

```
#include <stdio.h>

int main(){

int a;

float b;

double c;

char d;

printf("Size of int=%d bytes\n",sizeof(a));

printf("Size of float=%d bytes\n",sizeof(b));

printf("Size of double=%d bytes\n",sizeof(c));

printf("Size of char=%d byte\n",sizeof(d));

return 0; }
```

**Practice 3**

**Write a program to display number of days in February using conditional operator.**

**Sample code:**

```
#include <stdio.h>
int main(){
char feb;
int days;
printf("Enter l if the year is leap year otherwise enter 0: ");
scanf("%c",&feb);
days=(feb=='l')?29:28;
printf("Number of days in February = %d",days);
return 0; }
```

**Sample output**

```
Enter l if the year is leap year otherwise enter 0: 1

Number of days in February =29
```

**Do it yourself**

**Write a program to check whether a year is leap year or not.**

**Practice 4**

**Write a program to solve a quadratic equation.**

```
#include<stdio.h>
#include<math.h>
main(){
float a, b, c, d, root1, root2;
printf("Input values of a, b, and c:");
scanf("%f %f %f",&a,&b,&c);
d= sqrt(b*b-4*a*c);
root1=(-b+d)/(2*a);
root2=(-b-d)/(2*a);
printf("Root1=%f  Root2=%f", root1,root2);
}
```

**Sample output:**

Input values of a, b, and c: 2 4 -16

Root1=2.00 Root2=-4.00

**Do it yourself**

**Write a program to calculate the square of a value by using the function power and also by using shorthand operator.**

**Practice 5**

**Write a program to enter two numbers from keyboard and swap the value of these two numbers.**

```
#include <stdio.h>
 int main(){
float a, b, temp;
printf("Enter value of a: ");
```

```
scanf("%f",&a);
printf("Enter value of b: ");
scanf("%f",&b);
temp = a; /* Value of a is stored in variable temp */
a = b; /* Value of b is stored in variable a */
b = temp; /* Value of temp(which contains initial value of a) is stored in variable b*/
printf("\nAfter swapping, value of a = %.2f\n", a);
printf("After swapping, value of b = %.2f", b);
return 0; }
```

**Sample output**

```
Enter value of a: 2
Enter value of b: 5
After swapping, value of a =5
After swapping, value of b =2
```

**Do it yourself**

**Write a C Program to compute and display remainder and quotient using only two variables.**

**Practice 6**

**Write a C program to check whether a character is alphabet or not.**

```
*/ #include <stdio.h>
int main() {
char c, result;
printf("Enter a character: ");
scanf("%c",&c);
result=( (c>='a'&& c<='z') || (c>='A' && c<='Z')) ?1: 0;
printf("the entered character is %c.", result);
return 0; }
```

**Sample output**

Enter a character: K

K is an alphabet

**Do it yourself**

**Write a C program to check whether a number entered by user is even or odd.**

**Character test functions**

| Functions | Meaning |
|---|---|
| **isdigit(c)** | is **c** a digit? |
| **islower(c)** | is **c** a lower case letter? |
| **isupper(c)** | is **c** a upper case letter? |
| **isalpha(c)** | is **c** an alphabetic character? |
| **toupper** | converts lower case into upper case |
| **tolower:** | converts upper case into lower case |

**Exercises**

- **Write a program to check whether a character is vowel or consonant.**
- **Write a program to convert a lowercase letter into upper case and vice versa.**
- **Write a C program to select the largest of three input values.**
- **Write a program to calculate the value of side using the following formula:**

$$side = \sqrt{a^2 + b^2 - 2ab\ cos(x)}$$

# Lab 3: Decision Making and Branching

**Objective: The main objectives of this lab are to:**

- **be introduced with different control or decision making statements.**
- **learn how they work to make decisions in case of a particular condition.**

**Practice 1**

**Write your first C program to print the number entered by user only if the number entered is negative.**

**Sample code**

```
#include <stdio.h>

int main(){

int num;

printf("Enter a number to check.\n");

scanf("%d",&num);

if(num<0) {

printf("Number = %d\n",num); }

printf("The if statement in C programming is easy.");

return 0; }
```

**Sample output:**

```
Enter a number to check.

-2

Number = -2
```

**Do it yourself**

**Write a C program to check whether a number entered by user is even or odd.**

**Practice 2**

**Write a C program to relate two integers entered by user using = or > or < sign.**

**Sample code:**

```
#include <stdio.h>
int main(){
int numb1, numb2;
printf("Enter two integers to check\n");
scanf("%d %d",&numb1,&numb2);
if(numb1==numb2) //checking whether two integers are equal.
printf("Result: %d = %d",numb1,numb2);
else if(numb1>numb2) //checking whether numb1 is greater than numb2.
printf("Result: %d > %d",numb1,numb2);
else printf("Result: %d > %d",numb2,numb1);
return 0; }
```

**Sample output**

```
Enter two integers to check.
5 3
Result: 5 > 3
```

**Do it yourself**

**Write a C program to do the grading of students on the basis of average marks.**

| **Average Marks** | **Grade** |
|---|---|
| **80-100** | **Honors** |
| **60-79** | **First Division** |
| **50-59** | **Second Division** |
| **40-49** | **Third Division** |
| **0-39** | **Fail** |

**~:** is a 1's complement operator**.** It works as:

$$\sim b = -b + 1$$

So, a - ~b -1
= a-(-b + 1) + 1
= a + b – 1 + 1
= a + b

**Practice 3**

**Write a c program to add two numbers without using addition operator.**

**Sample Code:**

```
#include<stdio.h>

int main(){

   int a,b;
   int sum;
   printf("Enter any two integers: ");
   scanf("%d%d",&a,&b);
   sum = a - ~b -1;
   printf("Sum of two integers: %d",sum);

   return 0;
}
```

**Do It Yourself**

**Write a c program or code to subtract two numbers without using subtraction operator.**

**Practice 4**

**Write a program to create a simple calculator for addition, subtraction, multiplication and division using switch...case statement in C programming.**

**Sample Code:**

```
# include <stdio.h>
int main() {
char o;
float num1,num2;
printf("Enter operator either + or - or * or divide : ");
scanf("%c",&o);
printf("Enter two operands: ");
scanf("%f%f",&num1,&num2);
```

```
switch (o) {
case '+':
       printf("%.1f + %.1f = %.1f",num1, num2, num1+num2);
       break;
case '-':
      printf("%.1f - %.1f = %.1f",num1, num2, num1-num2);
      break;
case '*':
      printf("%.1f * %.1f = %.1f",num1, num2, num1*num2);
      break;
case '/':
      printf("%.1f / %.1f = %.1f",num1, num2, num1/num2);
      break;
default:
     /* If operator is other than +, -, * or /, error message is shown */
      printf("Error! operator is not correct");
      break;
       }
return 0;
}
```

**Do It Yourself**

**Write a C Program to do the grading of students on the basis of average marks using switch...case statement in C programming.**

**Exercise**

An electric power distribution company charges its domestic consumers as follows:

| *Consumption Units* | *Rate of Charge* |
|---|---|
| 0 – 200 | Rs. 0.50 per unit |
| 201 – 400 | Rs. 100 plus Rs. 0.65 per unit excess of 200 |
| 401 – 600 | Rs. 230 plus Rs. 0.80 per unit excess of 400 |
| 601 and above | Rs. 390 plus Rs. 1.00 per unit excess of 600 |

- **Write a program to read the customer number and power consumed units and print the amount to be paid by the customer.**

# Lab 4: Decision Making and Looping

**Objective: The main objectives of this lab are to:**

- Know about how to make decision and branching in programming environment
- Learn how to perform looping statement

**Practice 1**

**Write a program to find the sum of first n natural numbers (1, 2, 3... are called natural numbers) where n is entered by user.**

**Sample Code:**

```
#include <stdio.h>
int main(){
int n, count, sum=0;
printf("Enter the value of n.\n");
scanf("%d",&n);
for(count=1;count<=n;++count) //for loop terminates if count>n
{ sum+=count; /* this statement is equivalent to sum=sum+count */
 }
printf("Sum=%d",sum);
return 0;
}
```

**Do It Yourself**

**Write a C program to find and display all the factors of a number entered by an user**.

**Practice 2**

**Write a C program to check whether a number is palindrome or not.**

**Sample Code:**

```
#include <stdio.h>
int main() {
int n, reverse=0, rem,temp;
printf("Enter an integer: ");
scanf("%d", &n);
temp=n;
while(temp!=0)
{
rem=temp%10;
reverse=reverse*10+rem;
temp/=10; } /* Checking if number entered by user and it's reverse number is equal. */
if(reverse==n)
printf("%d is a palindrome.",n);
else
printf("%d is not a palindrome.",n);
```

```
return 0;
}
```

**Sample Output**
Enter an integer: 12321
12321 is a palindrome.

**Do It Yourself**
**Write a c program to find number of digits in a number.**

**Practice 3**
**Write a C program to check whether a number is prime or not**.

**Sample Code**
```
#include <stdio.h>
int main()
{
int n, i, flag=0;
printf("Enter a positive integer: ");
scanf("%d",&n);
for(i=2;i<=n/2;++i) {
if(n%i==0)
{
flag=1;
break;
 }
}
if (flag==0)
printf("%d is a prime number.",n);
else
printf("%d is not a prime number.",n);
return 0;
 }
```

**Sample Output**
Enter a positive integer: 29
29 is a prime number.

**Do It Yourself**
**Write a c program to display all prime numbers between two interval entered by user.**

**Practice 4**
**Write a c program to display Fibonacci series up to certain number entered by user.**

**Sample Code:**

```
#include <stdio.h>
int main()
{
int t1=0, t2=1, display=0, num;
printf("Enter an integer: ");
scanf("%d",&num);
printf("Fibonacci Series: %d+%d+", t1, t2); /* Displaying first two terms */
display=t1+t2;
while(display<num)
{ printf("%d+",display);
t1=t2;
t2=display;
display=t1+t2;
}
return 0;
}
```

**Sample Output**

```
Enter an integer: 200
Fibonacci Series: 0+1+1+2+3+5+8+13+21+34+55+89+144+
```

**Do It yourself**

**Write a C program to display factorial of an integer if user enters non-negative integer.**

**Practice 5**

**Write a C Program to Find Greatest Common Divisor of two integer values.**

**Sample Code**

```
#include <stdio.h>
int main()
{
int num1, num2, i, hcf;
printf("Enter two integers: ");
scanf("%d %d", &num1, &num2);
for(i=1; i<=num1 || i<=num2; ++i)
{
if(num1%i==0 && num2%i==0) /* Checking whether i is a factor of both number */
hcf=i;
}
printf("H.C.F of %d and %d is %d", num1, num2, hcf);
return 0;
 }
```

**Sample Output:**

Enter two integers: 14 35
HCF of 14 and 35 is 7

**Do It Yourself**

**Write a c program to find least common multiple of two integer values.**

**Exercises**

- **Write a C program to display the following output using for loop.**

- **Write a C program to find the product of 4 integers entered by a user. If user enters 0 skip it.**
- **Write a C program that takes an integer number from user and reverses that number.**