Lab# 04

Arithmetic Operators, Arithmetic Expressions and math functions

4.1 Objective

Learn using operators, expressions and math functions.

4.2 Scope

The student should know the following at the end of this lab:

1. Arithmetic Operators
2. Arithmetic Expressions
3. Math Functions
4. Writing Complete Programs

4.3 Useful Concepts

Arithmetic Operators:

To solve most programming problems, you will need to write arithmetic expressions that manipulate type int and double data. In C language, these are the basic arithmetic operators: addition (+), subtraction (-), multiplication (*), division (/), and remainder (%)

If the operands are of different types, the one with weaker type will be raised to the level of the other type, then the operation will be performed. The order is char, int, long, float, double.

The division between two integer numbers results in an integer result (as you can see 5/2 gives 2 not 2.5).

The division by zero is undefined. Either you get a compilation warning or a run time error.

The remainder operator % is related to the division one. This operator will give the remainder produced by dividing the two numbers (5 % 2 = 1). Therefore, this operator is not used with double values. If one of the operand or both are double, you will get an error message from the compiler saying:

Illegal use of floating point

Arithmetic Expressions:

Arithmetic expressions contain a combination of the arithmetic operations including brackets:

x = z – (a + b / 2) + w * -y

To evaluate the expression, we need to follow the precedence rule which is as follows:

1. ( ) expression within parentheses

2. +, - unary operators (plus and minus sign)

3. *, /, % multiplication, division and remainder are evaluated from left to right

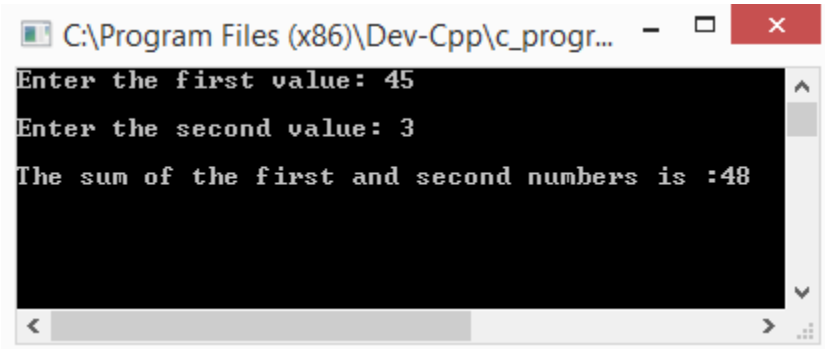
4. +, - addition and subtraction are evaluated from left to right

4.4 Examples:

Example1: Program illustrates how to input two variables from the user and display their sum. Both variables are integers.

```
#include<stdio.h>
#include<conio.h>
int main ()
{
        int val1,val2, result=0;
        printf("Enter the first value: ");
        scanf("%d", &val1);
        printf("\nEnter the second value: ");
        scanf("%d", &val2);
        result=val1+val2;
        printf("\nThe sum of the first and second numbers is :%d", result);
        getch();
}
```

Here is the output of the above result

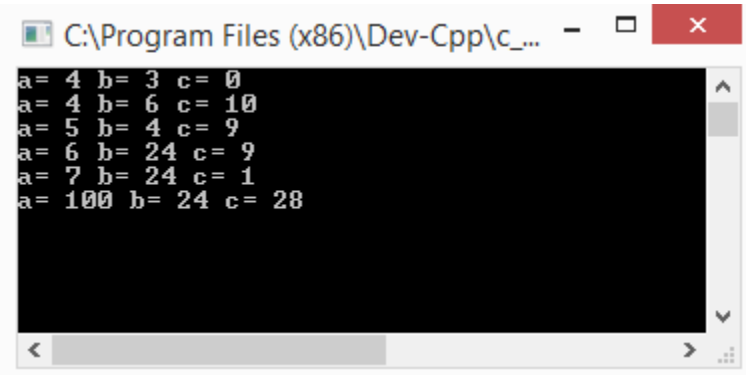


Example2: This program illustrates some arithmetic properties of integer (int) variables. Trace through the program to make sure you understand the values of each variable in all stages of the program.

```
#include<stdio.h>
```

```
#include<conio.h>
int main ()
{
        int a=4, b, c;
        printf("a= %d b= %d c= %d",a,b,c);
        b=6;
        c=a+b;
        printf("\na= %d b= %d c= %d",a,b,c);
        a++;                                    //this statement is similar to a=a+1;
        b -= 2;                                 //this statement is similar to b= b-2;
        --c;                                    //this statement is similar to c=c-1;
        printf("\na= %d b= %d c= %d",a,b,c);
        b *= ++a;                               //a=a+1;, b=b*a;
        printf("\na= %d b= %d c= %d",a,b,c);
        c /= a++;                               //c=c/a;, a=a+1;
        printf("\na= %d b= %d c= %d",a,b,c);
        a = (b+c)*4;                            //First (b+c) then multiply the result with 4.
        c = b+c*4;                              //First c*4 then result is added with b.
         printf("\na= %d b= %d c= %d",a,b,c);
        getch();
        }
```

The output for the above program is

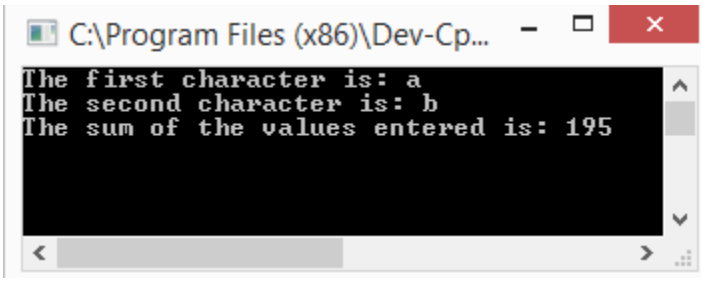


Example3: Program illustrates how to initialize two characters and displays the effect of addition.

```
#include<conio.h>
```

```
#include<stdio.h>
int main ()
{
        char val1,val2;
        int sum=0;
        val1='a';
        val2='b';
        printf("The first character is: %c",val1);
        printf("\nThe second character is: %c",val2);
        sum=val1+val2;
        printf("\nThe sum of the values entered is: %d",sum);
        getch();
}
```

The output for the above given program is

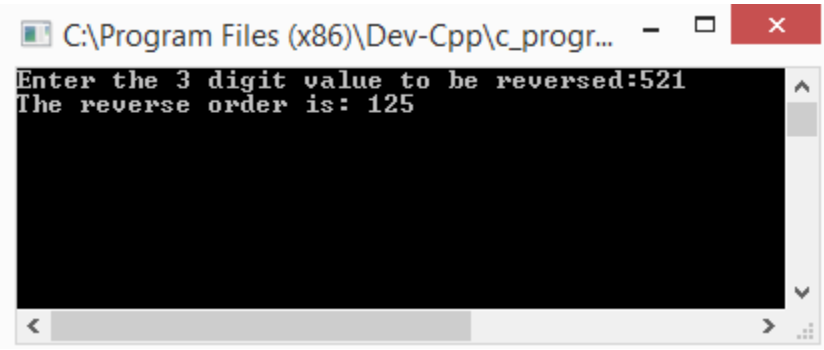


Example 4: Input a 3 digit value from the user (forexample 521) and display it in reverse order (i.e. 125).

```
#include<conio.h>
#include<stdio.h>
int main ()
{
        int n,a,b;
        printf("Enter the 3 digit value to be reversed:");
        scanf("%d", &n);
        a=n/100;
        n=n%100;
        b=n/10;
```

```
    n=n%10;
    printf("The reverse order is: %d%d%d",n,b,a);
    getch();
}
```

The output of this program is shown below



Math function:

To do some advanced mathematical functions in C, there is a header file called <math.h> that has different trigonometric and algebraic functions. Here are some frequently used functions:

pow(x,y)	x^y	pow(5,3) = 5^3 = 125
sqrt(x)	$\sqrt{x}$ (x > 0)	sqrt(4) = $\sqrt{4}$ = 2
log(x)	ln x (x > 0)	log(5) = 1.6094
log10(x)	$\log_{10} x$ (x > 0)	log10(5) = 0.698970
exp(x)	e^x	exp(2) = 7.3891
sin(x)	sin x (x in radian)	sin(90) = 0.893997
cos(x)	cos x (x in radian)	cos(90) = -0.448074
tan(x)	tan x (x in radian)	tan(90) = -1.9952
asin(x)	$\sin^{-1}$ x (x in [-1,1])	asin (0) = 0
acos(x)	$\cos^{-1}$ x (x in [-1,1])	acos(0) = 1.570796
atan(x)	$\tan^{-1}$ x	atan(0) = 0

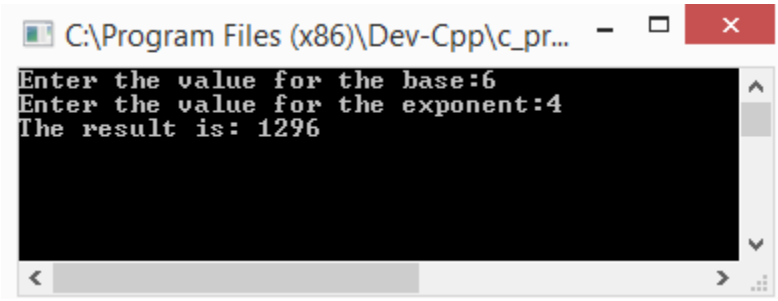
Note that you have to include the header file math.h before you use any of these functions. Also, the return type of these functions is double.

Example1: Input the values for base and exponent and calculate its power using the pow(x,y) built in function.

```
#include<conio.h>
```

```
#include<stdio.h>
#include<math.h>
int main ()
{
        int base,expo,result=0;
        printf("enter the value for the base:");
        scanf("%d",&base);
        printf("enter the value for the exponent:");
        scanf("%d",&expo);
        result= pow(base,expo);
        printf("the result is: %d", result);
        getch();
}
```

The output for the given program is



4.5 Exercise for Lab

Exercise 1: Write a program that finds the area of a triangle given the length of its sides: a, b, c.

$$area = \sqrt{s \cdot (s-a) \cdot (s-b) \cdot (s-c)}$$

$$s = \frac{a+b+c}{2}$$

Exercise 2: Write a program taking two values as inputs from the user and display the results for all the basic arithmetic operations performed on them

Addition

Subtraction

Multiplication

Division

Modulus

Exercise 3: Write a program that inputs a 4 digit value from the user (for example 6382) and displays a result with an increment of 1 in each digit (i.e. 7493)