PROGRAMMING IN C

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Practical No: 1

<u>Title:</u> TO LEARN THE BASICS OF C PROGRAMMING

<u>Objective:</u>

1. Understanding the basics of C programming
2. Understanding data types, variables, variable declaration, variable initialization, constants
3. Understanding the proper use and relation of Algorithm and Flowchart in Programming

<u>Theory:</u>

- <u>Algorithm</u>: The step by step procedure to perform a task is known algorithm. The sequence of steps when executed in proper or correct order helps us get desired result.
- <u>Flowchart</u>: Flowchart is the diagrammatical representation of an algorithm. Flowcharts are more convenient to understand and interpret.
- <u>Constant</u>: Constant is an entity that doesn't change its value throughout the program
- <u>Variable</u>: Variable is an entity that changes its value according to the program.
- <u>Data Types</u>: Data type specifies the type of data that a variable can store such as integer, float, character, double. This determines the type and size of data associated with variables.
- <u>Variable Declaration and Initialization</u>: Variable declaration and initialization is the process of declaring a variable to a certain address in the beginning of a program using different data type according to the type, size and precision needed. When a variable is declared, initialization should also be done.

Example:

```c
#include<stdio.h>
int main() {
int a;   ← (Here a is a variable which is being declared as an integer)
char b;
printf("Size of a: %dbytes\n",sizeof(a));
printf("Size of b: %dbyte\n",sizeof(b));
return 0;
}
```

OUTPUT

Size of a: 4 bytes ←(Here we can see that diff data type occupies different

Size of b: 1 byte   space)

Practical:

1) Write a program to read the graphical characters and print their equivalent ASCII code
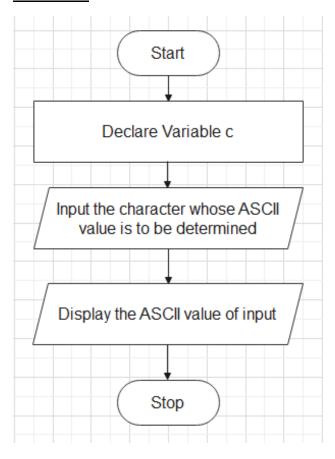
Algorithm:

Step 1: Start

Step 2: Declare variable a

Step 3: Display "Input the ASCII value whose character is to be determined"

Step 4: Input the ASCII value

Step 5: Display the corresponding character

Step 6: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.1

#include<stdio.h>
int main()
{
    char c;
    printf("Enter character whose ASCII value is to be determined:\n ");
    scanf("%c", &c);
// %d displays the integer value of a character
// %c displays the actual character
    printf("The ASCII value of %c = %d", c, c );
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 1.exe"

Enter character whose ASCII value is to be determined:
 e
The ASCII value of e = 101
Process returned 0 (0x0)   execution time : 1.001 s
Press any key to continue.
```

2) Write a program to read ASCII value and print the equivalent character.
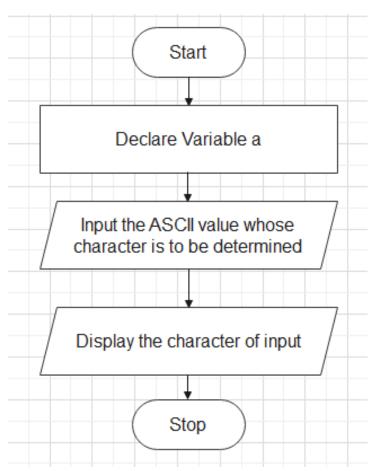
Algorithm:

Step 1: Start

Step 2: Declare variable a

Step 3: Display "Input the ASCII value whose character is to be determined"

Step 4: Input the ASCII value

Step 5: Display the corresponding character

Step 6: Stop

Flowchart:

```
                  ┌──────────┐
                  │  Start   │
                  └────┬─────┘
                       │
                       ▼
        ┌──────────────────────────────┐
        │                              │
        │      Declare Variable a      │
        │                              │
        └──────────────┬───────────────┘
                       │
                       ▼
        ╱──────────────────────────────╱
       ╱   Input the ASCII value whose ╱
      ╱   character is to be determined╱
     ╱────────────────┬───────────────╱
                      │
                      ▼
        ╱──────────────────────────────╱
       ╱                               ╱
      ╱  Display the character of input╱
     ╱────────────────┬───────────────╱
                      │
                      ▼
                 ┌──────────┐
                 │   Stop   │
                 └──────────┘
```

Program:

```c
//Drishya Neupane 201648

//Program No.2

#include<stdio.h>
int main()
{
    int a;
    printf("Input the equivalent ASCII value : ");
    scanf("%d",&a);
/* a is assigned the integer input by the user
    %c displays the character*/
    printf("The ASCII character is : %c", a);
    return 0;

}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 2.exe"

Input the equivalent ASCII value : 245
The ASCII character is : |
Process returned 0 (0x0)   execution time : 3.300 s
Press any key to continue.
```

3) Write a program to read the value of two variables, compute sum, difference and product

Algorithm:

Step 1: Start

Step 2: Declare variable a, b
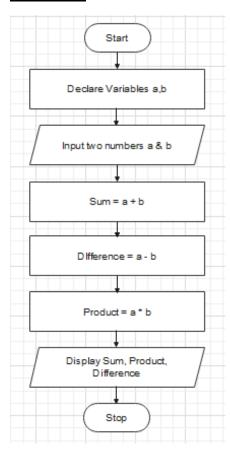
Step 3: Display "Input two numbers"

Step 4: Input two numbers

Step 5: Sum = a + b, Difference = a - b, Product = a * b

Step 6: Display Sum, Product, Difference

Step 7: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.3

#include<stdio.h>
int main(){
    int a,b,Sum,Difference,Product;
//The two numbers are individually asked for the user not to make it confusing
    printf("Enter a number : ");
    scanf("%d",&a);
    printf("\nEnter another number : ");
    scanf("%d",&b);
//Their value is stored in respective address and each operation is performed
    Sum = a + b;
    printf("The Sum is: %d",Sum);
    Difference = a - b;
    printf("\nThe Difference is: %d",Difference);
    Product = a * b;
    printf("\nThe product is: %d",Product);
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 3.exe"
Enter a number : 5

Enter another number : 3
The Sum is: 8
The Difference is: 2
The product is: 15
Process returned 0 (0x0)   execution time : 2.772 s
Press any key to continue.
```

4) Write a program to calculate cb^3/d^2

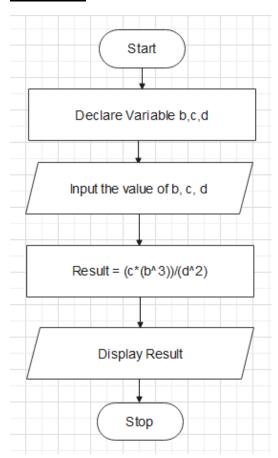Algorithm:

Step 1: Start

Step 2: Declare variable b,c,d

Step 3: Display "Input the value of b, c, d"

Step 4: Input the values of b, c, d

Step 5: Result = (c*(b^3))/(d^2)

Step 6: Display Result

Step 7: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.4

#include<stdio.h>
#include<math.h>
int main()
{
    float b,c,d,Result;
//The variables are declared as float because the result of division or square or cube can be decimals
    printf("Enter the values of b,c and d:\n");
    scanf("%f %f %f",&b, &c, &d);
/*The pow() function assigns power to a variable;where the first part
shows variable and the second shows the power it's raised to*/
    Result = (c*pow(b, 2))/pow(d, 3);
    printf("The answer is: %f", Result);
    return 0;
    }
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 4.exe"

Enter the values of b,c and d:
1
4
6
The answer is: 0.018519
Process returned 0 (0x0)   execution time : 4.987 s
Press any key to continue.
```

5) Write a program to read radius of sphere and calculate volume and surface area
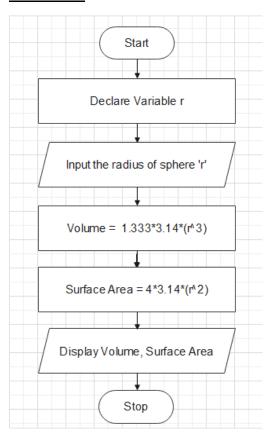
Algorithm:

Step 1: Start

Step 2: Declare variable r

Step 3: Display "Input the radius of sphere 'r'"

Step 4: Input radius r

Step 5: Volume = 1.333*3.14*(r^3), Surface Area = 4*3.14*(r^2)

Step 6: Display Volume, Surface Area

Step 7: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.5

#include<stdio.h>
int main(){
    float r, Volume ,Area;
//The variables are considered as float for similar reason as earlier program
    printf("Enter the radius of sphere: ");
    scanf("%f",&r);
    Volume = 1.3333*3.14*pow(r,3);
//1.333 & 3.14 is used to get more accurate result
    Area = 4*3.14*pow(r,2);
    printf("The Volume is %.2f and the Surface Area is %.2f", Volume, Area);
//Restriction in decimal place is applied to get minimal answer
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 5.exe"
Enter the radius of sphere: 4.5
The Volume is 381.50 and the Surface Area is 254.34
Process returned 0 (0x0)   execution time : 2.430 s
Press any key to continue.
```

6) Write a program to read the radius of circle and calculate the circumference and area

Algorithm:

Step 1: Start

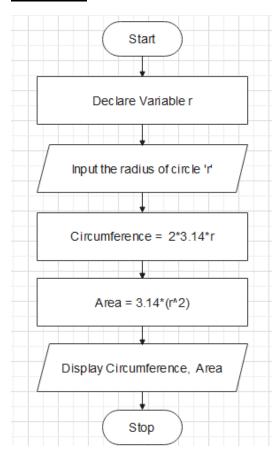Step 2: Declare variable r

Step 3: Display "Input the radius of circle 'r'"

Step 4: Input radius r

Step 5: Circumference = 2*3.14*r,Surface Area = 3.14*(r^2)

Step 6: Display Circumference, Surface Area

Step 7: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.6

#include<stdio.h>
int main(){
    float r, Circumference ,Area;
//The variables are considered as float for similar reason as earlier program
    printf("Enter the radius of circle: ");
    scanf("%f",&r);
    Circumference = 2*3.14*r;
//3.14 is used to get more accurate result
    Area = 3.14*pow(r,2);
     printf("The Circumference is %.2f and the Area is %.2f", Circumference, Area);
//Restriction in decimal place is applied to get minimal answer
    return 0;
}
```

Output:


```
"C:\Users\user\Desktop\C programming\Program 6.exe"
Enter the radius of circle: 2
The Circumference is 12.56 and the Area is 12.56
Process returned 0 (0x0)   execution time : 2.306 s
Press any key to continue.
```

7) Write a program to calculate the sum of following series
$$1- x^2/2! + x^4/4! + x^6/6! + x^8/8! - x^{10}/10!$$
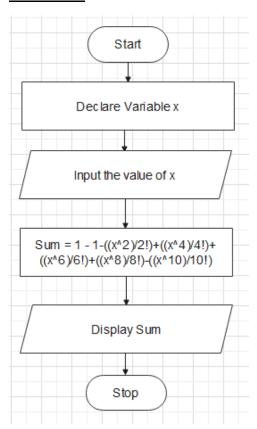
Algorithm:

Step 1: Start

Step 2: Declare variable x

Step 3: Display "Input the value of x"

Step 4: Input the value of x

Step 5: Sum = 1 - 1-((x^2)/2!)+((x^4)/4!)+((x^6)/6!)+((x^8)/8!)-((x^10)/10!)

Step 6: Display Sum

Step 7: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.7

#include<stdio.h>
int main(){
    int x;
    float Sum;
//Due to sum being sequence with division and factorial included, it's declared float
    printf("Input the value of x:" );
    scanf("%d",&x);
//The formula given is used
    Sum = 1-(pow(x,2)/2)+(pow(x,4)/(4*3*2))+(pow(x,6)/(6*5*4*3*2))+(pow(x,8)/(8*7*6*5*4*3*2))-(pow(x,10)/(10*9*8*7*6*5*4*3*2));

    printf("Sum = %f", Sum);
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 7.exe"

Input the value of x:1
Sum = 0.543080
Process returned 0 (0x0)   execution time : 1.502 s
Press any key to continue.
```

8) Write a program to read the temperature in centigrade and convert it to Fahrenheit [hint F = 1.8C +32]

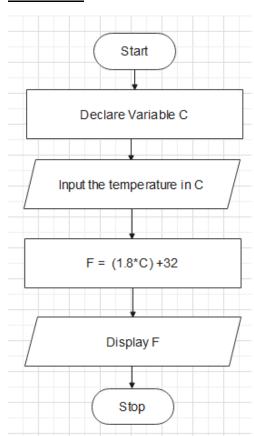Algorithm:

Step 1: Start

Step 2: Declare variable C

Step 3: Display "Input the temperature in Celsius"

Step 4: Input temperature in Celsius

Step 5: F = (1.8*C)=32

Step 6: Display F

Step 7: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.8

#include<stdio.h>
int main(){
    float C, F;
//The variables are considered float because temperature can be in decimals
    printf("Enter the temperature in Celcius: ");
    scanf("%f",&C);
//The formula provided is used
    F = (1.8*C) + 32;
    printf("The temperature in Farenheit is : %.2f F",F);
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 8.exe"

Enter the temperature in Celcius: 39.8
The temperature in Farenheit is : 103.64 F
Process returned 0 (0x0)   execution time : 2.817 s
Press any key to continue.
```

9) Write a program to read the principle, time and rate and calculate the interest and total amount

Algorithm:

Step 1: Start
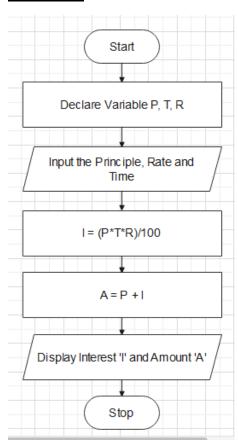
Step 2: Declare variable P, T, R

Step 3: Display "Input the Principle, Rate and Time"

Step 4: Input Principle, Rate and Time

Step 5: I = (P*T*R)/100, A = P + I

Step 6: Display I and A

Step 7: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.9

#include<stdio.h>
int main(){
    float P, T, R, I, A;
    printf("Input Principle,Time & Rate\n");
    scanf("%f%f%f",&P,&T,&R);
    I = (P*T*R)/100;
    A = P + I;
//the formula provided are used
    printf("The Simple Interest is %f and\nThe amount is %.2f",I,A);
//Value of amount is reduced to 2 decimal places because more than 2 decimal place isn't practical
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 9.exe"

Input Principle,Time & Rate
15000
6
8.6
The Simple Interest is 7740.000488 and
The amount is 22740.00
Process returned 0 (0x0)   execution time : 7.680 s
Press any key to continue.
```

10) **Calculate the mass of air in an automobile tire, using the formula**
PV = 0.37 m (T + 460)

Where P = Pressure, T = Temperature and V = Volume

(For this question we re-arrange the formula to find m)

Algorithm:
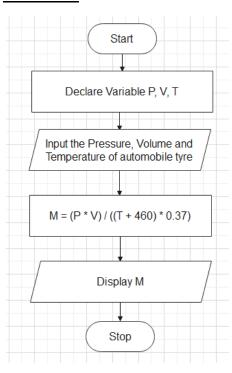
Step 1: Start

Step 2: Declare variable P, V, T

Step 3: Display "Input the Pressure, Volume and Temperature of the automobile tyre"

Step 4: Input Pressure, Volume and Temperature

Step 5: M = (P*V)/((T + 460)*0.37)

Step 6: Display M

Step 7: Stop

Flowchart:

Program:

```c
//Drishya Neupane 201648

//Program No.10

#include<stdio.h>
int main(){
    float P, V, T, M;
    printf("Input the Pressure,Volume and Temperature of air inside automobile tyre (in SI):\n");
    scanf("%f%f%f",&P,&V,&T);
/*Given P*V = 0.37*M*(T+460) which can also be written as
M=P*V/((T+460)*0.37) */
    M = (P * V) / ((T + 460) * 0.37);
    printf("The Mass of air in the automobile tyre is %.3fkg",M);
    return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 10.exe"

Input the Pressure,Volume and Temperature of air inside automobile tyre (in SI):
4
250
35
The Mass of air in the automobile tyre is 5.460kg
Process returned 0 (0x0)   execution time : 6.476 s
Press any key to continue.
```

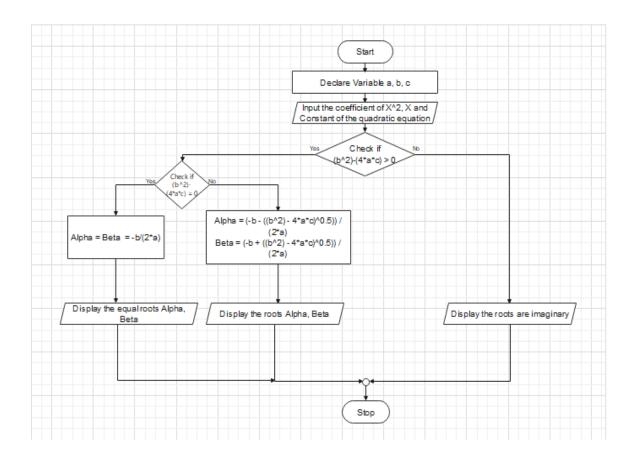## 11) Write a program to calculate real and equal roots of a quadratic equation.

Algorithm:

Step 1: Start
Step 2: Declare variable a, b, c
Step 3: Display "Input the coefficient of x^2, x and constant of the quadratic equation"
Step 4: Input coefficient of x^2, x and constant (i.e. a, b, c)
Step 5: Check if (b^2)-(4*a*c)>0
    Step 5.1: If Step 5 is true
        Step 5.1.1: Check if (b^2)-(4*a*c) ==0
            Step 5.1.1.1: If Step 5.1.1 is true
                Step 5.1.1.1.1: The roots are equal, Alpha=Beta=-b/(2*a)
                Step 5.1.1.1.2: Display Alpha, Beta

            Step 5.1.1.2: If Step 5.1.1 is false
                Step 5.1.1.2.1: Alpha = (-b - ((b^2) - 4*a*c)^0.5)) / (2*a)
                          Beta = (-b + ((b^2) - 4*a*c)^0.5)) / (2*a)
                Step 5.1.1.2.2: Display Alpha, Beta

    Step 5.2: If Step 5 is false
        Step 5.2.1: Display the roots are imaginary
Step 6: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.11

#include<stdio.h>
#include<math.h>
int main(){
    float a, b, c, value, alpha, beta;
    printf("Enter the coefficient of X^2, X and Constant of the quadratic equation whose roots are Alpha and Beta:\n");
    scanf("%f%f%f",&a,&b,&c);
//B^2-4ac is used to check whether the roots are real imaginary or equal
    value = (pow(b,2) - (4*a*c));
//if.......else if condition is used to check different conditions
if(value > 0)//The roots are real
{
    alpha = (-b + sqrt(value))/(2*a);
    beta =  (-b - sqrt(value))/(2*a);
    printf("The roots are %.2f & %.2f",alpha,beta);
}
else if (value==0)//The roots are equal
{
    alpha = beta = -b / (2 * a);
    printf("The roots Alpha = Beta = %.2f",alpha);
}
else //If none conditions are satisfied,the roor is imaginary
{
    printf("The roots Alpha and Beta are imaginary");
}
return 0;
}
```

Output:

```
"C:\Users\user\Desktop\C programming\Program 11.exe"

Enter the coefficient of X^2, X and Constant of the quadratic equation whose roots are Alpha and Beta:
1
-1
-2
The roots are 2.00 & -1.00
Process returned 0 (0x0)   execution time : 2.902 s
Press any key to continue.
```

```
"C:\Users\user\Desktop\C programming\Program 11.exe"

Enter the coefficient of X^2, X and Constant of the quadratic equation whose roots are Alpha and Beta:
2
-1
1
The roots Alpha and Beta are imaginary
Process returned 0 (0x0)   execution time : 2.239 s
Press any key to continue.
```

```
"C:\Users\user\Desktop\C programming\Program 11.exe"

Enter the coefficient of X^2, X and Constant of the quadratic equation whose roots are Alpha and Beta:
1
-4
4
The roots Alpha = Beta = 2.00
Process returned 0 (0x0)   execution time : 3.301 s
Press any key to continue.
```

12) Write a program to read the weight in gram and convert it to kilogram and gram.
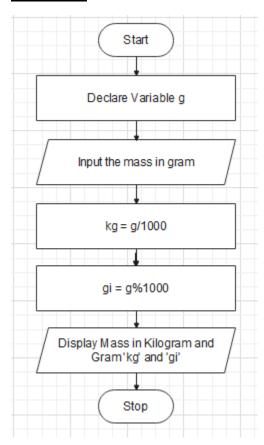
Algorithm:

Step 1: Start

Step 2: Declare variable g

Step 3: Display "Input the mass in gram"

Step 4: Input the mass in gram

Step 5: kg = g/1000, gi= g%1000

Step 6: Display kg and gi

Step 7: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.12

#include<stdio.h>
int main(){
    int kg,gi,g;
    printf("Enter the weight (in gram): ");
    scanf("%d",&g);
//The weight in gram is taken and basic unitary method formula is used
    kg = g/1000;
    gi =(g%1000);
//The modulo function produces the remainder
    printf("The weight in Kilogram is %dKg and %dg",kg,gi);
return 0;
}
```

Output:

13) Write a program to use sizeof operator to determine the size of different data types.
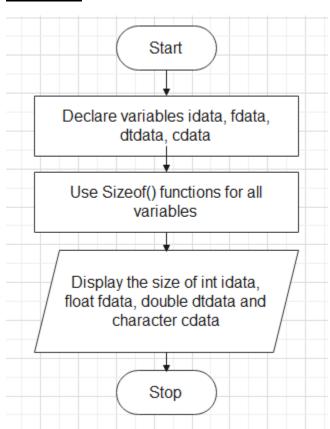
Algorithm:

Step 1: Start

Step 2: Declare variable idata, fdata, dtdata, cdata

Step 3: Use Sizeof() function to determine size

Step 4: Display the size of int idata, float fdata, double dtdata and character cdata

Step 5: Stop

Flowchart:

Program:

```
//Drishya Neupane 201648

//Program No.13

#include<stdio.h>
int main() {
    int idata;
    float fdata;
    double dtdata;
    char cdata;
// Sizeof evaluates the size of a variable
    printf("Size of int: %dbytes\n",sizeof(idata));
    printf("Size of float: %dbytes\n",sizeof(fdata));
    printf("Size of double: %dbytes\n",sizeof(dtdata));
    printf("Size of char: %dbyte\n",sizeof(cdata));
    return 0;

}
```

Output:

```
 "C:\Users\user\Desktop\C programming\Program 13.exe"

Size of int: 4bytes
Size of float: 4bytes
Size of double: 8bytes
Size of char: 1byte

Process returned 0 (0x0)    execution time : 0.075 s
Press any key to continue.
```