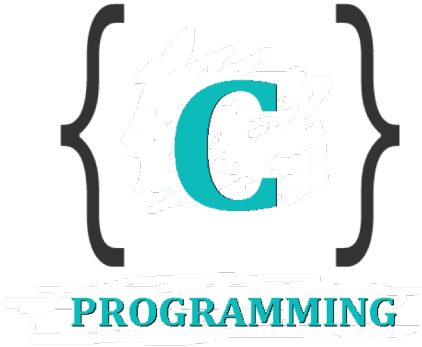

IT 105: Introduction to Programming

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Lecture 6

Decisions! Decisions

- By default the instructions in a program are executed sequentially.
- In serious programming situations, seldom do we want the instructions to be executed sequentially.
- We want a set of instructions to be executed in one situation, and an entirely different set of instructions to be executed in another situation

Decision Control Instructions

- **Decision control instruction** can be implemented in C using
  - **if** statement
  - **if-else** statement
  - The conditional operators

- C uses the keyword if to implement the decision control instruction. The general form of **if** statement:
  - *if (this condition is true)*
    - *execute this statement ;*

Decision Control Instructions

Relational Operators

- Condition can be specified using C's 'relational' operators.
- Relational operators allow us to compare two values.

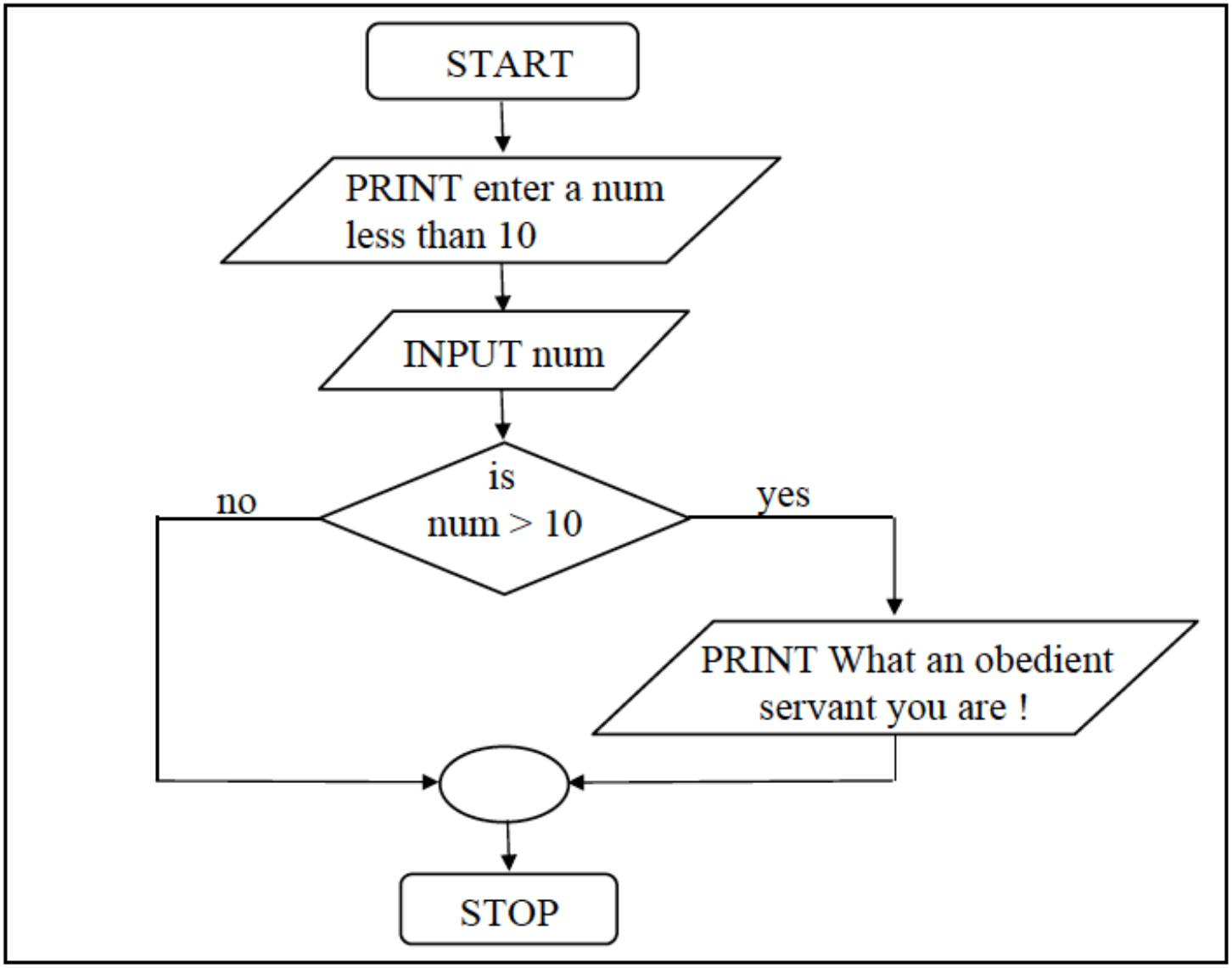
this expression	is true if
x == y	x is equal to y
x != y	x is not equal to y
x < y	x is less than y
x > y	x is greater than y
x <= y	x is less than or equal to y
x >= y	x is greater than or equal to y

Relational Operators

```
/* Demonstration of if statement */
main( )
{
        int num ;
        printf ( "Enter a number less than 10 " ) ;
        scanf ( "%d", &num ) ;

        if ( num <= 10 )
                printf ( "What an obedient servant you are !" ) ;
}
```

"If" Statement



Example (IF)

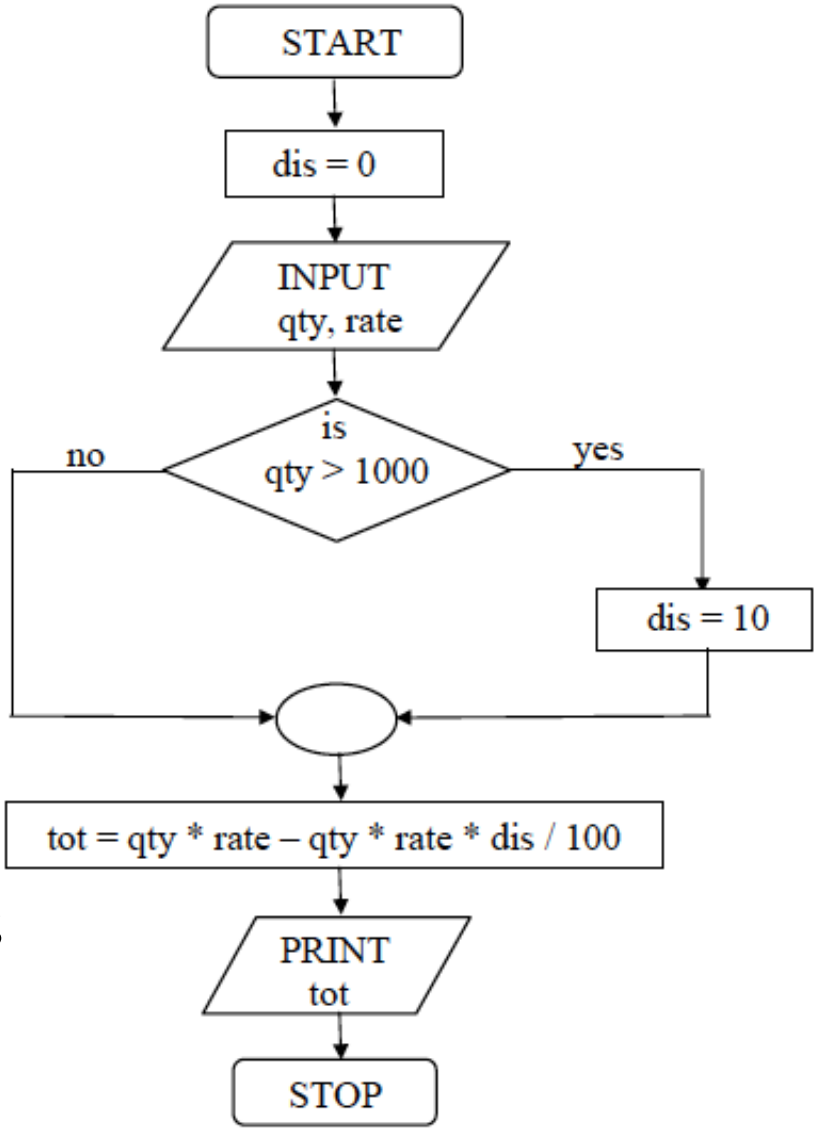
- While purchasing certain items, a discount of 10% is offered if the quantity purchased is more than 1000. If quantity and price per item are input through the keyboard, write a program to calculate the total expenses.

Flowchart - Example

```
/* Calculation of total expenses */
main( )
{
        int qty, dis = 0 ;
        float rate, tot ;

        printf ("Enter quantity and rate ") ;
        scanf ("%d %f", &qty, &rate) ;

        if ( qty > 1000 )
        dis = 10 ;
        tot=(qty*rate)-(qty*rate*dis/100 ) ;
        printf ("Total expenses = Rs. %f", tot);
}
```



The Real Thing with "IF"

if (condition)
statement;

The expression can be any valid expression including a relational expression.

Can even use arithmetic expressions in the **if statement**.

if (expression)
statement;

The Real Thing with "IF"

- if (3 + 2 % 5)
  printf ("This works") ;

- if (a = 10)
  printf ("Even this works") ;

- if (-5)
  printf ("Surprisingly even this works") ;
- if (a==b==c)
  Result of a==b is compared with c

Note that in C a non-zero value is considered to be true, whereas a 0 is considered to be false.

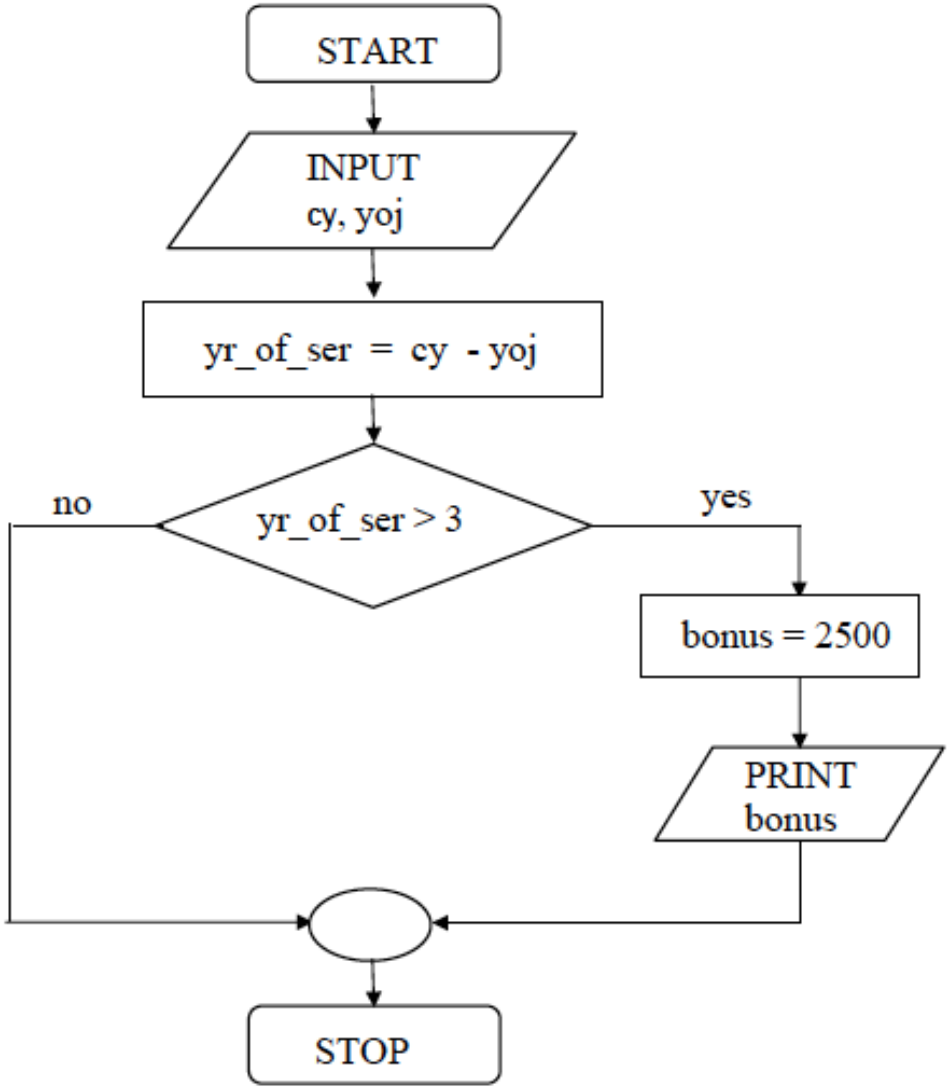
Multiple Statements within "IF"

- In a "IF" statement multiple statements are to be executed then
  - They must be placed within a pair of braces.

Example:
The current year and the year in which the employee joined the organization are entered through the keyboard. If the number of years for which the employee has served the organization is greater than 3 then a bonus of Rs. 2500/- is given to the employee. If the years of service are not greater than 3, then the program should do nothing.

Multiple Statements within "IF" - Example

```
/* Calculation of bonus */
main( )
{
        int bonus, cy, yoj, yr_of_ser ;
        printf ("Enter current year and
year of joining") ;
        scanf ("%d %d", &cy, &yoj);
        yr_of_ser = cy - yoj ;
        if (yr_of_ser > 3)
        {
                bonus = 2500 ;
                printf ("Bonus = Rs.
%d", bonus);
        }
}
```



The if-else Statement

- The **if statement** by itself will execute a single statement, or a group of statements, when the expression following if evaluates to true.
- It does nothing when the expression evaluates to false.

- Can we execute one group of statements if the expression evaluates to true and another group of statements if the expression evaluates to false?

- Of course! This is what is the purpose of the **else statement**

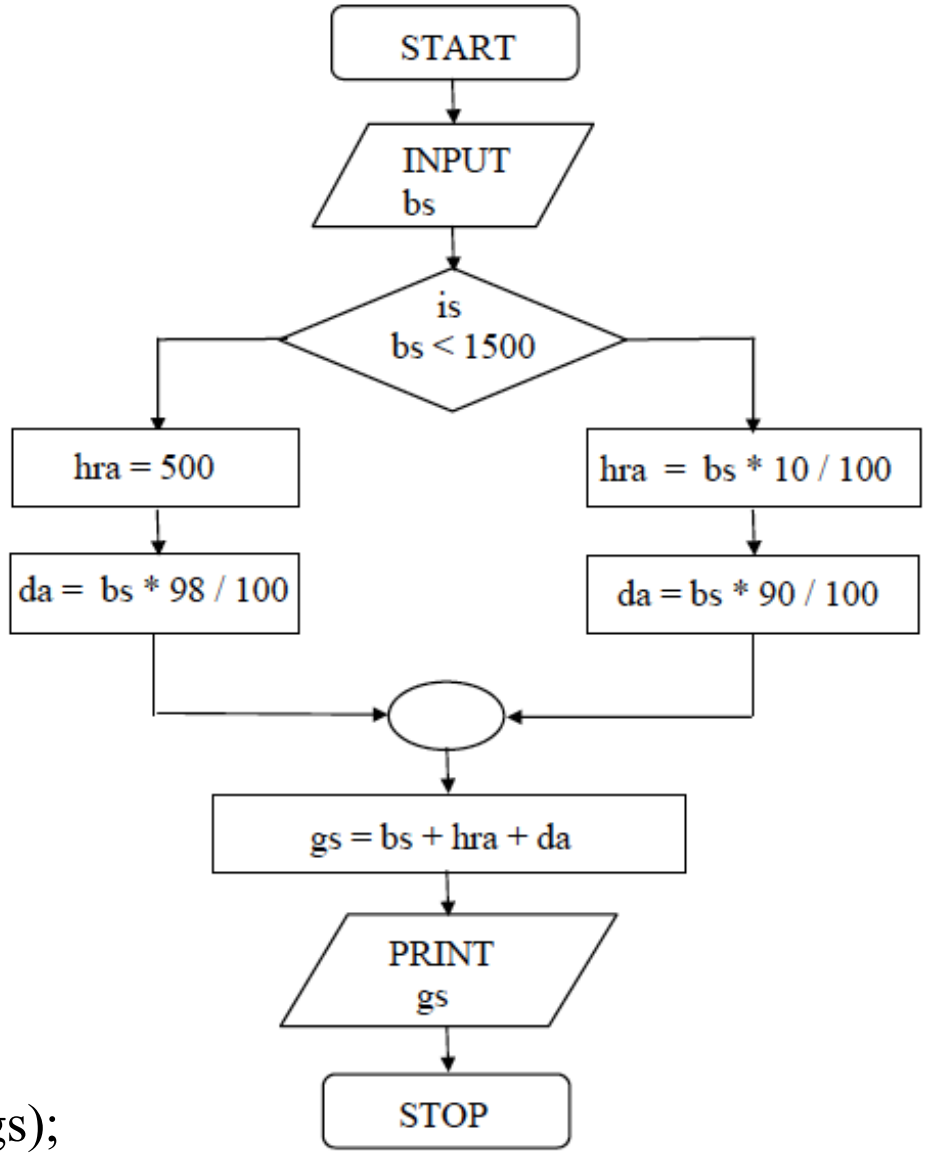
Example (IF-ELSE)

In a company an employee is paid as under:

If his basic salary is less than Rs. 1500, then HRA = 10% of basic salary and DA = 90% of basic salary. If his salary is either equal to or above Rs. 1500, then HRA = Rs. 500 and DA = 98% of basic salary. If the employee's salary is input through the keyboard write a program to find his gross salary.

"IF-ELSE" - Example

```
/* Calculation of gross salary */
main( )
{
        float bs, gs, da, hra ;
        printf ( "Enter basic salary " ) ;
        scanf ( "%f", &bs ) ;
        if ( bs < 1500 )
        {
                hra = bs * 10 / 100 ;
                da = bs * 90 / 100 ;
        }
        else
        {
                hra = 500 ;
                da = bs * 98 / 100 ;
        }
        gs = bs + hra + da ;
        printf ("gross salary=Rs. %f", gs);
}
```



Points to Remember

- The group of statements after the **if** upto and not including the **else** is called an 'if block'. Similarly, the statements after the **else** form the 'else block'.
- Notice that the **else** is written exactly below the **if**. The statements in the if block and those in the else block have been indented to the right.
- Had there been only one statement to be executed in the if block and only one statement in the else block we could have dropped the pair of braces.
- As with the **if** statement, the default scope of **else** is also the statement immediately after the **else**. To override this default scope a pair of braces as shown in the above example must be used.

Nested IF-ELSES

- Write an entire **if-else** construct within either the body of the **if** statement or the body of an **else** statement.
  - This is called ‘nesting 'of **if**s

Nested IF-ELSES (Example)

```
/* A quick demo of nested if-else */
main( )
{
        int  i ;
        printf ( "Enter either 1 or 2 " ) ;
        scanf ( "%d", &i ) ;
        if ( i == 1 )
                printf ( "You would go to heaven !" ) ;
        else
        {
                if ( i == 2 )
                        printf ( "Hell was created with you in mind") ;
                else
                        printf ( "How about mother earth !" ) ;
        }
}
```

Forms of *IF*

```
if ( condition )
        do this ;
```

```
if ( condition )
{
        do this ;
        and this ;
}
```

```
if ( condition )
        do this ;
else
        do this ;
```

```
if ( condition )
{
        do this ;
        and this ;
}
else
{
        do this ;
        and this ;
}
```

Forms of *IF*

```
if ( condition )
        do this ;
else
{
        if ( condition )
                do this ;
        else
        {
                do this ;
                and this ;
        }
}
```

```
if ( condition )
{
        if ( condition )
                do this ;
        else
        {
                do this ;
                and this ;
        }
}
else
        do this ;
```

Word of Caution

Guess output of the program?

```
#include <stdio.h>
main()
{
        int i;
        printf("Enter Value of i");
        scanf("%d", &i);

        if (i=5)
                printf("You have entered 5\n");
        else
                printf("You have entered something other than 5\n");
}
```

Word of Caution

Enter value of i 200

o/p:

Enter value of i 5

o/p:

Enter value of i 9999

o/p:

Surprised?

Word of Caution: Another

Guess output of the program?

```
#include <stdio.h>
main()
{
        int i;
        printf("Enter Value of i");
        scanf("%d", &i);

        if (i==5);
                printf("You have entered 5\n");
}
```

You have entered 5

Word of Caution: Another

```
#include <stdio.h>
main()
{
        int i;
        printf("Enter Value of i");
        scanf("%d", &i);

        if (i==5)
        ;
                printf("You have entered 5\n");
}
```

Note:

- if the condition evaluates to true, the ; (null statement, which does nothing in execution gets executed.
- If the condition fails, printf() gets executed.
- In any case, printf() gets executed – fail or pass

Exercise

- What will be output of the following program

```
# include <stdio.h>
main( )
{
        int a = 300, b, c ;
        if ( a >= 400 )
                b = 300 ;
                c = 200 ;
                printf ( "\n%d %d", b, c ) ;
}
```

Exercise

- What will be output of the following program

```
# include <stdio.h>
main( )
{
        int a = 500, b, c ;
        if ( a >= 400 )
                b = 300 ;
                c = 200 ;
                printf ( "\n%d %d", b, c ) ;
}
```

Exercise

- What will be output of the following program

```
# include <stdio.h>
main( )
{
        int x =3;
        float y = 3.0;
        if ( x == y )
                printf (“x and y are equal\n”) ;
        else
                printf(“x and y are not equal\n”);
}
```

Exercise

- What will be output of the following program

```
# include <stdio.h>
main( )
{
        int x =3, y, z;
        y = x = 10;
        z = x < 10;
        printf ("x = %d, y = %d, z = %d\n", x, y, z) ;
}
```

Exercise

- What will be output of the following program

```
# include <stdio.h>
main( )
{
        int x = 10, y = 20, z = 5, i;
        i = x < y < z;
        printf("%d\n", i);
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
int X=40;
main()
{
        int X=20;
        printf("%d\n", X);
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        int i = 65 ;
        char j = 'A' ;
        if ( i == j )
                printf ( "C is WOW" ) ;
        else
                printf( "C is a headache" ) ;
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        float a = 12.25, b = 12.52 ;
        if ( a = b )
                printf ( "\na and b are equal" ) ;
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        int j = 10, k = 12 ;
        if ( k >= j )
        {
                {
                        k = j ;
                        j = k ;
                }
        }
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        if ( 'X' < 'x' )
                printf ( "\nascii value of X is smaller than
that of x" ) ;
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        int x = 10 ;
        if ( x >= 2 ) then
                printf ( "\n%d", x ) ;
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        int x = 10, y = 15 ;
        if ( x % 2 = y % 3 )
                printf ( "\nCarpathians" ) ;
}
```

Exercise

- What will be output of the following program

```
#include <stdio.h>
main( )
{
        int x = 30 , y = 40 ;
        if ( x == y )
                printf( "x is equal to y" ) ;
        elseif ( x > y )
                printf( "x is greater than y" ) ;
        elseif ( x < y )
                printf( "x is less than y" ) ;
}
```

Exercise

- Any integer is input through the keyword. Write a program to find out whether it is an odd or even number.

https://ideone.com/FMV8bS