# UNIT II

## CONTROL FLOW AND FUNCTIONS

Looping and logic, Python Flow Control, if-else, for loop, while loop, break and continue, Illustrative programs, Python Functions, Python Functions, function argument, python recursion, python module, python package. Illustrative Programs using Conditional Statements: If, Elif and Else; Loops: While, for and nested loops; Functions

### CONTROL FLOW STATEMENTS:

A *control statement* is a statement that determines the control flow of a set of instructions, i.e., it decides the sequence in which the instructions in a program are to be executed.

Types of Control Statements are

- ○ Sequential Control – program is executed sequentially from the first line to the last line of the program.
- ○ Selection Control – Executes only a selected set of statements.
- ○ Iterative Control – Executes a set of statements repeatedly.

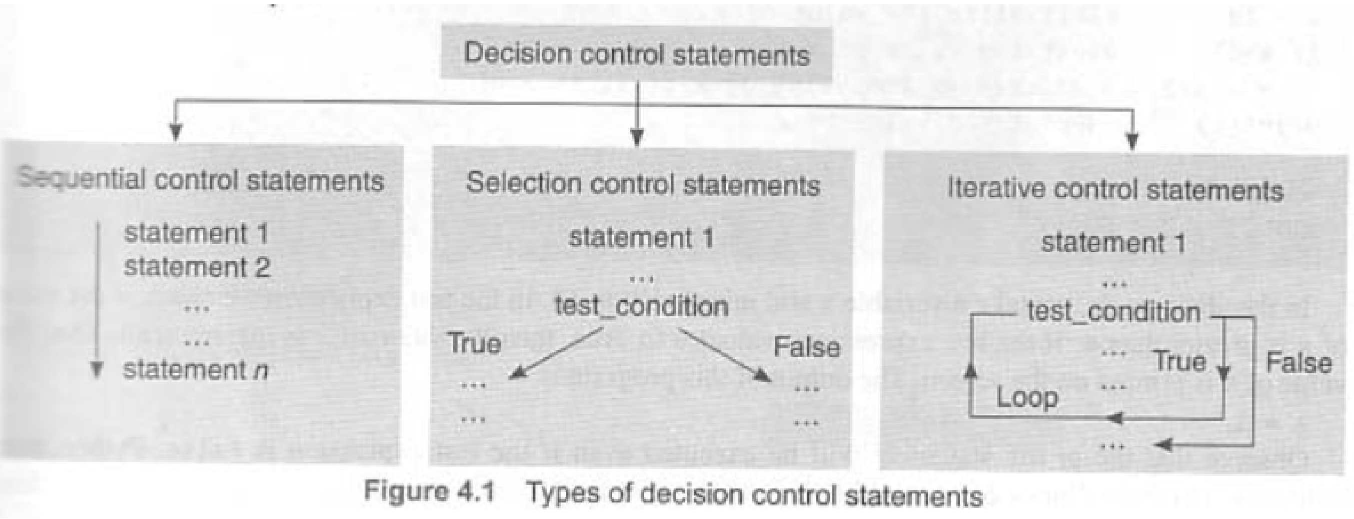


Figure 4.1 Types of decision control statements

## SELECTION / CONDITIONAL BRANCHING STATEMENTS:

The decision control statements jumps from one part of the program to another part of the program depending on whether the condition is satisfied or not. These statements are known as Conditional Branching Statements or Selection Control Statements.

Different types of conditional branching statements are as follows:

- If statement
- If-Else Statement
- Nested if Statement
- If – Elif – Else Statement

The decision control statements work based on the value of the Boolean expression.

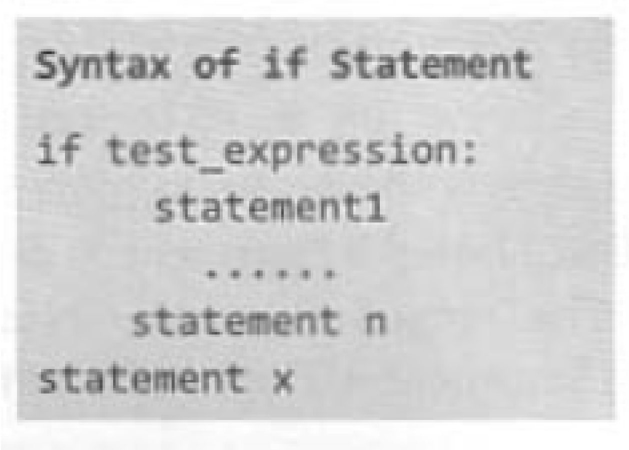
The statements that have a keyword followed by colon (:) at the end is called the **Header** and the other statements following the header are called the **Suite**. Header and Suite are together called as **Clause**.

After the header, the instructions in a suite are indented at the same level.

## if STATEMENT:

It is the easiest and simplest form of decision control statements

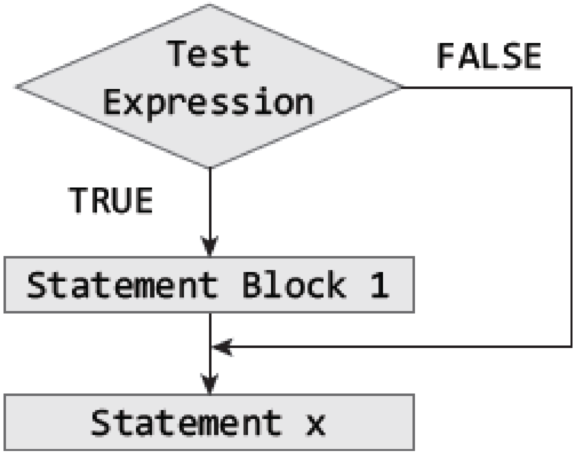
The general form of if statement is given as:



```
Syntax of if Statement

if test_expression:
     statement1
       ......
    statement n
statement x
```

Proper indentation is followed to describe the body of the if statement.



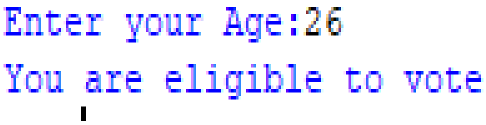
If the test condition is True, then Block 1 statements are executed.

If the test condition is False, then the statements next to the if block are executed.

Example 1: Write a program to determine whether a person is eligible to vote. **(Observation)**

```
age = int(input('Enter your Age:'))
if age>18:
        print("You are eligible to vote")
```

Output:

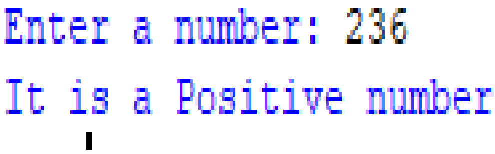


```
Enter your Age:26
You are eligible to vote
```

Example 2: Write a program to determine whether a number is positive. **(Observation)**

```
num = int (input("Enter a number: "))
if (num > 0):
        print ("It is a Positive number")
```

Output:

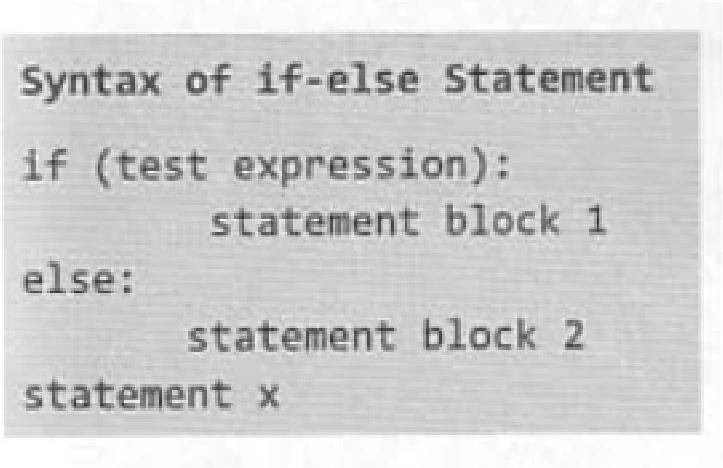


```
Enter a number: 236
It is a Positive number
```

**if – else STATEMENT:**

In this form, the test expression is evaluated and if the result is True, the statement(s) followed by the expression is executed else if the result is False, the next set of statements are executed.

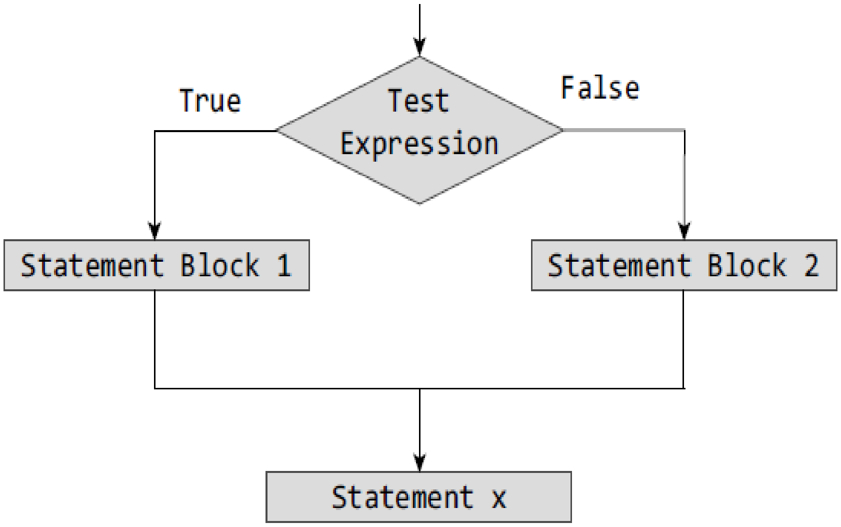
The general form of if – else statement is given as:



Syntax of if-else Statement

```
if (test expression):
        statement block 1
else:
       statement block 2
statement x
```

The flow diagram of if – else statement is as follows:

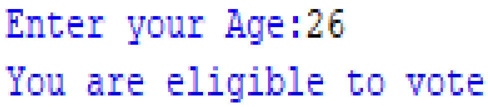


First, the test expression is evaluated that provides a Boolean value. If the test condition is True, then Block 1 statements are executed else if the test condition is False, then Block 2 statements are executed.

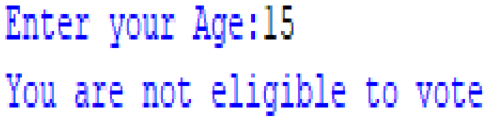
**Example 1**: Program to determine whether a person is eligible to vote.

```
age = int(input('Enter your Age:'))
if age>18:
        print('You are eligible to vote')
else:
        print('You are not eligible to vote')
```

Output:



```
Enter your Age:26
You are eligible to vote
```

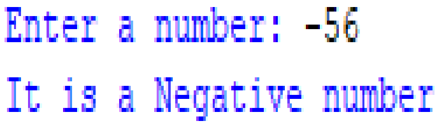


```
Enter your Age:15
You are not eligible to vote
```

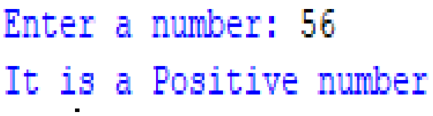
**Example 2**: Program to determine whether a number is positive.

```
num = int (input("Enter a number: "))
if (num > 0):
        print ("It is a Positive number")
else:
         print ("It is a Negative number")
```

Output:



```
Enter a number: -56
It is a Negative number
```



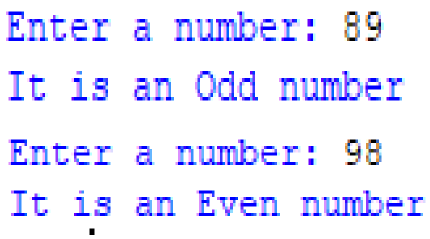
```
Enter a number: 56
It is a Positive number
```

**Example 3**: Program to find the greater of two numbers. **(Observation)**

```
number1 = int(input("Enter the first number: "))
number2 = int(input("Enter the second number: "))
if (number1>number2):
      large=number1
else:
      large=number2
print("Large=",large)
```

**Example 4**: Program to find if a number is an Odd number or Even number. **(Observation)**

```
num = int(input("Enter a number: "))
if (num % 2 == 0):
        print ("It is an Even number")
else:
        print ("It is an Odd number")
```



```
Enter a number: 89
It is an Odd number
Enter a number: 98
It is an Even number
```

**NESTED if STATEMENTS:**

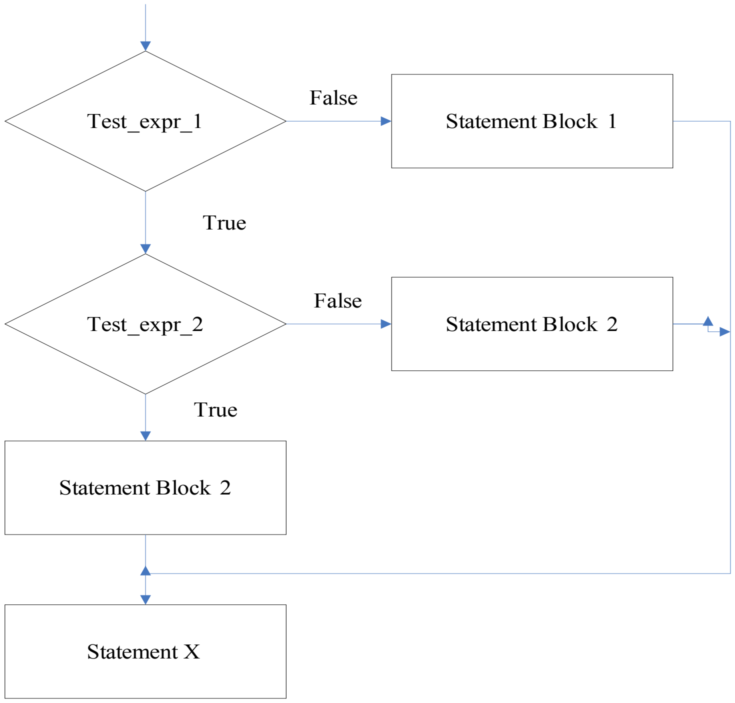
A statement that contains other statements is called Compound Statements.

When multiple checks have to be done, the *if* statements can be nested, i.e: they can be placed inside another.

The general form of Nested if statement is given as:

```
Syntax for Nested if Statements:
if (test_expr_1):
        if (test_expr_2):
              Statement Block 1
        else:
              Statement Block 2
else:
        Statement Block 3
Statement x
```

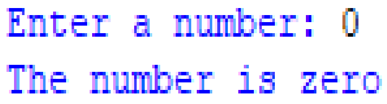
The flow diagram of Nested if statement is as follows:



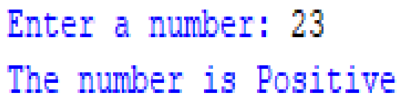
First, the test expression 1 is evaluated that provides a Boolean value. If the test condition is True, then again a test expression 2 is evaluated. If the test condition is true, then Block 1 statements are executed else if the test condition is False, then Block 2 statements are executed. If test expression 1 yields false result, then Block 3 statements are executed.

**Example 1**: Program to determine whether a number is a positive or negative number **(Observation)**

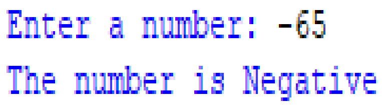
```
num = int (input("Enter a number: "))
if (num >= 0):
    if (num==0):
        print ("The number is zero")
    else:
        print ("The number is Positive")
else:
    print ("The number is Negative")
```



```
Enter a number: 0
The number is zero
```



```
Enter a number: 23
The number is Positive
```

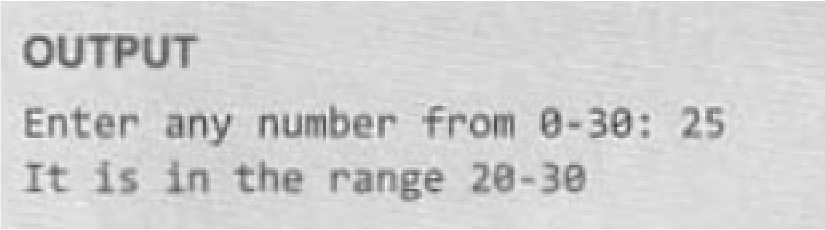


```
Enter a number: -65
The number is Negative
```

- Example 2: Program that prompts the user to enter a number and then print its interval

  **(Observation)**

```
Num=int(input("Enter any number from 0-30:"))
if(num>=0 and num<10):
        print("It is in the range 0-10")
if(num>=10 and num<20):
        print("It is in the range 10-20")
if(num>=20 and num<30):
        print("It is in the range 20-30")
```



```
OUTPUT
Enter any number from 0-30: 25
It is in the range 20-30
```

**if – elif – else STATEMENT:**

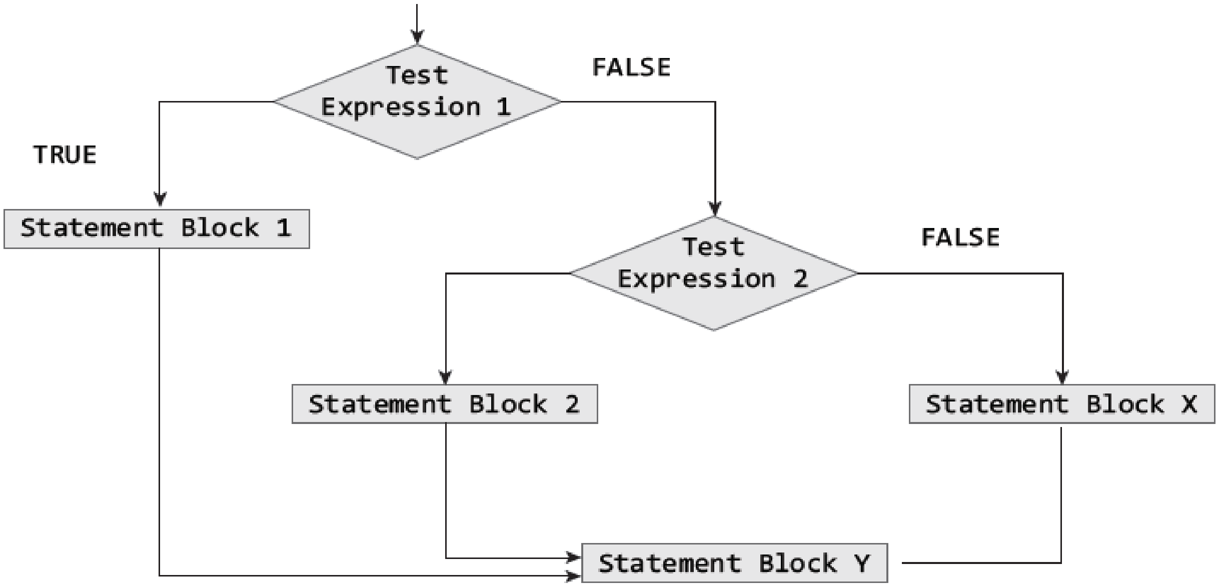
Python supports if-elif-else statements to test additional conditions apart from the initial test expression. The if-elif-else construct works in the same way as a usual if-else statement.

The elif statement is a shorter form of else – if statement.

The general form of if – elif – else statement is given as:

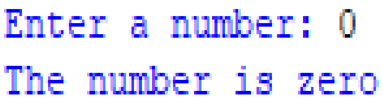
```
Syntax for if-elif-else statement:
if (test_expr_1):
      Statement Block 1
Elif (test_expr_2):
      Statement Block 2
else:
        Statement Block 3
Statement x
```

The flow diagram of if – elif - else statement is as follows:

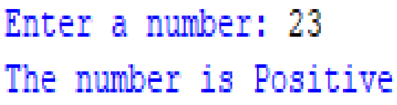


**Example 1**: Program to determine whether a number is a positive, negative, or equal to zero

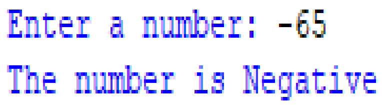
```
num = int (input("Enter a number: "))
if (num==0):
        print ("The number is zero")
elif (num>0):
        print ("The number is Positive")
else:
        print ("The number is Negative")
```



```
Enter a number: 0
The number is zero
```



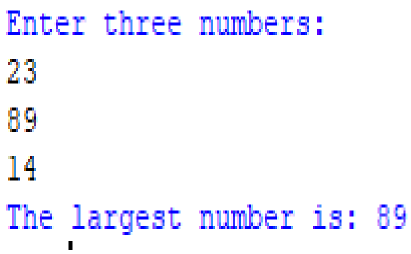
```
Enter a number: 23
The number is Positive
```



```
Enter a number: -65
The number is Negative
```

**Example 2**: Program to determine the greatest of three numbers

```
print ('Enter three numbers:')
a = int(input())
b = int(input())
c = int(input())
if (a>b and a>c):
        print ("The largest number is",a)
elif (b>c) :
        print ("The largest number is:",b)
else:
        print ("The largest number is:",c)
```

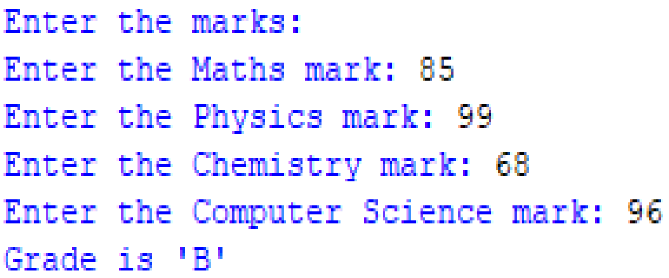


```
Enter three numbers:
23
89
14
The largest number is: 89
```

**Example 3**: Program to determine the grade of a student based on marks: **(Observation)**

```
print ('Enter the marks:')
maths = int(input("Enter the Maths mark: "))
phy = int(input("Enter the Physics mark: "))
chem = int(input("Enter the Chemistry mark: "))
cs = int(input("Enter the Computer Science mark: "))
tot = maths + phy + chem + cs
avg = tot / 4
if (avg>90):
        print ("Grade is 'A'")
elif ((avg>80) and (avg<=90)):
        print ("Grade is 'B'")
elif ((avg>70) and (avg<=80)):
```

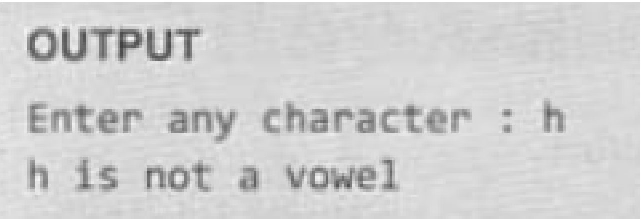
```
          print ("Grade is 'C'")
elif ((avg>60) and (avg<=70)):
          print ("Grade is 'D'")
elif ((avg>50) and (avg<=60)):
          print ("Grade is 'E'")
else:
          print ("Fail")
```



```
Enter the marks:
Enter the Maths mark: 85
Enter the Physics mark: 99
Enter the Chemistry mark: 68
Enter the Computer Science mark: 96
Grade is 'B'
```

- **Example 4: Program to determine whether the character entered is a vowel or not. (Observation)**

```
ch=input(“Enter any character:”)
if(ch==”A” or ch==”E” or ch==”I” or ch==”O” or ch==”U”):
print(ch, “is a vowel”)
elif(ch==”a” or ch==”e” or ch==”i” or ch==”o” or ch==”u”):
print(ch, “is a vowel”)
else:
print(ch, “is not a vowel”)
```



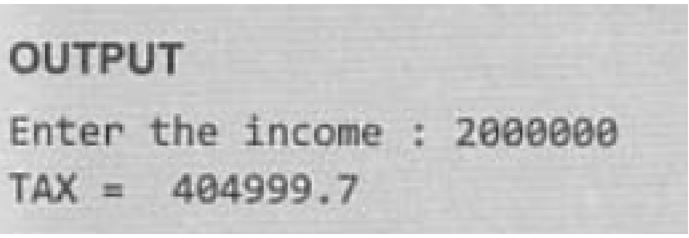
```
OUTPUT
Enter any character : h
h is not a vowel
```

- **Example 5: Program to calculate tax given the following conditions: (Observation)**
  **If income is less than 1,50,000 then no tax**
  **If taxable income is 1,50,001-3,00,000 then charge 10% tax**

**If taxable income is 3,00,001-5,00,000 then charge 20% tax**

**If taxable income is above 5,00,001 then charge 30% tax**

```
MIN1=150001
MAX1=300000
RATE1=0.10
MIN2=300001
MAX2=500000
RATE2=0.20
MIN3=500001
RATE3=0.30
income=int(input(“Enter the income:”))
taxable_income=income-150000
if(taxable_income<=0):
    tax=0
elif(taxable_income>=MIN1 and taxable_income<MAX1):
    tax=(taxable_income-MIN1)*RATE1
elif(taxable_income>=MIN2 and taxable_income<MAX2):
    tax=(taxable_income-MIN2)*RATE2
else:
    tax=(taxable_income-MIN3)*RATE3
print(“TAX=”,tax)
```



```
OUTPUT
Enter the income : 2000000
TAX =  404999.7
```

**Observation**

1. Write a program to determine whether a person is eligible to vote.
2. Write a program to determine whether a number is positive.
3. Program to find the greater of two numbers.
4. Program to find if a number is an Odd number or Even number.
5. Program to determine whether a number is a positive or negative number
6. Program that prompts the user to enter a number and then print its interval.
7. Program to determine the grade of a student based on marks.
8. Program to determine whether the character entered is a vowel or not.
9. Program to calculate tax given the following conditions:

**Record**

1. **A company decided to give bonus of 5% to employee if his/her year of service is more than 5 years. Ask user for their salary and year of service and print the net bonus amount.**
2. **Take values of length and breadth of a rectangle from user and check if it is square or not.**
3. **A shop will give discount of 10% if the cost of purchased quantity is more than 1000. Ask user for quantity Suppose, one unit will cost 100. Judge and print total cost for user.**
4. **A school has following rules for grading system:**

   **a. Below 25 – F**

   **b. 25 to 45 – E**

   **c. 45 to 50 – D**

   **d. 50 to 60 – C**

   **e. 60 to 80 – B**

   **f. Above 80 – A**

   **Ask user to enter marks and print the corresponding grade.**
5. **A student will not be allowed to sit in exam if his/her attendance is less than 75%. Take following input from user**

**Number of classes held**

**Number of classes attended.**

**And print percentage of class attended**

**Is student is allowed to sit in exam or not.**