## Program 4

**Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, equivalence class partitioning and decision-table approach and execute the test cases and discuss the results.**

```
#include<stdio.h>
int main()
{
int a,b,c,c1,c2,c3;
char istriangle;
do
{
 printf("\n enter 3 integers which are sides of triangle\n");
 scanf("%d%d%d", &a, &b, &c);
printf("\na=%d\tb=%d\tc=%d", a, b, c);
        c1 = a>=1 &&  a<=10;
        c2= b>=1 &&  b<=10;
        c3= c>=1 &&  c<=10;
 if (!c1)
  printf("\n the value of a=%d is not the range of permitted value", a);
 if (!c2)
 printf("\n the value of b=%d is not the range of permitted value", b);
 if (!c3)
 printf("\n the value of c=%d is not the range of permitted value", c);
 } while(!(c1 && c2 && c3));

// to check is it a triangle or not

if( a<b+c && b<a+c && c<a+b )
 istriangle='y';
else
 istriangle ='n';
if (istriangle=='y')
if ((a==b) && (b==c))
 printf("equilateral triangle\n");
 else if ((a!=b) && (a!=c) && (b!=c))
 printf("scalene triangle\n");
   else
 printf("isosceles triangle\n");
else
 printf("Not a triangle\n");
return 0;
}
```

## Test Case Name :Boundary Value Analysis for triangle problem

## Experiment Number : 1

**Test Data : Enter the 3 Integer Value( a , b And c )**

**Pre-condition : $1 \le a \le 10$ , $1 \le b \le 10$ and $1 \le c \le 10$ and $a < b + c$ , $b < a + c$ and $c < a + b$**

**Brief Description : Check whether given value for a Equilateral, Isosceles , Scalene triangle or can't form a triangle**

**Triangle Problem -Boundary value Test cases for input data**

| Case Id | Description | Input Data | | | Expected Output | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|---|
| | | a | b | c | | | | |
| 1 | Keep a and b at nominal value and vary c | 5 | 5 | 1 | Should display the message Isosceles triangle | | | |
| 2 | Keep a and b at nominal value and vary c | 5 | 5 | 2 | Should display the message Isosceles triangle | | | |
| 3 | Keep a and b at nominal value and vary c | 5 | 5 | 5 | Should display the message Equilateral triangle | | | |
| 4 | Keep a and b at nominal value and vary c | 5 | 5 | 9 | Should display the message Isosceles triangle | | | |
| 5 | Keep a and b at nominal value and vary c | 5 | 5 | 10 | Should display the message Not a triangle | | | |
| 6 | Keep a and cat nominal value and vary b | 5 | 1 | 5 | Should display the message Isosceles triangle | | | |
| 7 | Keep a and c at nominal value and vary b | 5 | 2 | 5 | Should display the message Isosceles triangle | | | |
| 8 | Keep a and c at nominal value and vary b | 5 | 5 | 5 | Should display the message Equilateral triangle | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | Keep a and c at nominal value and vary b | 5 | 9 | 5 | Should display the message Isosceles triangle | | | |
| 10 | Keep a and c at nominal value and vary b | 5 | 10 | 5 | Should display the message Not a triangle | | | |
| 11 | Keep b and cat nominal value and vary a | 1 | 5 | 5 | Should display the message Isosceles triangle | | | |
| 12 | Keep b and c at nominal value and vary a | 2 | 5 | 5 | Should display the message Isosceles triangle | | | |
| 13 | Keep b and c at nominal value and vary a | 5 | 5 | 5 | Should display the message Equilateral triangle | | | |
| 14 | Keep b and c at nominal value and vary a | 9 | 5 | 5 | Should display the message Isosceles triangle | | | |
| 15 | Keep b and c at nominal value and vary a | 10 | 5 | 5 | Should display the message Not a triangle | | | |

## Triangle Problem Worst-Case-Test Cases (one corner of a triangle)

| Case | Description | a | b | c | Expected Output | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|---|
| 1 | Enter the **min value** for a , b and c | **1** | 1 | **1** | Should display the message as Equilateral triangle | | | |
| 2 | Enter the **min value** for 2 items and **min +1** for any one item | **1** | 1 | **2** | Should display the message as Not a Triangle | | | |
| 3 | Enter the **min value** for 2 items and **Average value** for any one item | **1** | 1 | **5** | Should display the message as Not a Triangle | | | |
| 4 | Enter the **min value** for 2 items and **Max -1** for any one item | **1** | 1 | **9** | Should display the message as Not a Triangle | | | |
| 5 | Enter the **min value** for 2 items and **Max** for any one item | **1** | 1 | **10** | Should display the message as Not a Triangle | | | |
| 6 | Enter the **min value** for 2 items and **min +1** for any one item | **1** | 2 | **1** | Should display the message as Not a Triangle | | | |
| 7 | Enter the **min+1 value** for 2 items and **min** for any one item | **1** | 2 | **2** | Should display the message as Isosceles | | | |
| 8 | Enter the **min value** for **1 items, min+1** and **Average value** for any one item | **1** | 2 | **5** | Should display the message as Not a Triangle | | | |
| 9 | Enter the **min value** for **1 items, min+1** and **max-1** for any one item | **1** | 2 | **9** | Should display the message as Not a Triangle | | | |
| 10 | Enter the **min value** for **1 items, min+1** and **max** for any one item | **1** | 2 | **10** | Should display the message as Not a Triangle | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11 | Enter the **min value** for 2 **items, average value** for any one item | **1** | 5 | **1** | Should display the message as Not a Triangle | | | |
| 12 | Enter the **min value** for **1 items, min+1** and **average** for any one item | **1** | 5 | **2** | Should display the message as Not a Triangle | | | |
| 13 | Enter the **min value** for **1 items,** and **average** for any 2 items | **1** | 5 | **5** | Should display the message as Isosceles | | | |
| 14 | Enter the **min value** for **1 items, max-1** and **average** for any one item | **1** | 5 | **9** | Should display the message as Not a Triangle | | | |
| 15 | Enter the min value for **1 items, max** and **average** for any one item | **1** | 5 | **10** | Should display the message as Not a Triangle | | | |
| 16 | Enter the **min value** for 2 items and **max -1** for any one item1 | **1** | 9 | **1** | Should display the message as Not a Triangle | | | |
| 17 | Enter the **min value** for **1 items, min+1** and **max-1** for any one item | **1** | 9 | **2** | Should display the message as Not a Triangle | | | |
| 18 | Enter the **min value** for **1 items, max-1**and **Average value** for any one item | **1** | 9 | **5** | Should display the message as Not a Triangle | | | |
| 19 | Enter the **min value** for**1 items, max-1**for 2 items | **1** | 9 | **9** | Should display the message as Isosceles | | | |
| 20 | Enter the **min value** for **1 items, max-1**and **Max value** for any one item | **1** | 9 | **10** | Should display the message as Not a Triangle | | | |
| 21 | Enter the **min value** for **2 items** and **max** for any one item | **1** | 10 | **1** | Should display the message as Not a Triangle | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 22 | Enter the **min value** for **1 items, min+1** and **max** for any one item | **1** | 10 | **2** | Should display the message as Not a Triangle | | | |
| 23 | Enter the **min value** for **1 items, max** and **Average value** for any one item | **1** | 10 | **5** | Should display the message as Not a Triangle | | | |
| 24 | Enter the **min value** for **1 items, max-1** , and **max** for 1 items | **1** | 10 | **9** | Should display the message as Not a Triangle | | | |
| 25 | Enter the **min value** for **1 items,** and **Max value** for 2 items | **1** | 10 | **10** | Should display the message as Isosceles | | | |

### Special Value Test Cases

| Case | Description | a | b | c | Expected Output | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|---|
| 1 | Enter the **values** for a , b and c | **5** | 8 | **6** | Should display the message as Scalene triangle | | | |
| 2 | Enter the **out of boundary value** for a and b and **normal** value for c | **11** | 0 | **5** | Should display the message as value of a and b not in the permitted range | | | |
| 3 | Enter the **negative value** for a, b and c | **-1** | -4 | **-6** | Should display the message as value of a, b and c not in the permitted range | | | |
| 4 | Enter the **values** for a , b and c | **5** | **1** | **10** | Should display the message as Not a Triangle | | | |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | ✓ |

## Test Case Name :Equivalence class Analysis for triangle problem

## Experiment Number : 4

**Test Data: Enter the 3 Integer Value( a , b And c )**

**Pre-condition : 1 ≤ a ≤ 10 , 1 ≤ b ≤ 10 and 1 ≤ c ≤ 10 and a < b + c , b < a + c and c < a + b**

**Brief Description : Check whether given value for a Equilateral, Isosceles , Scalene triangle or can't form a triangle**

**Triangle Problem - Equivalence Class Test cases for input data**

| Weak and Strong Normal Equivalence class Testing | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Case Id | Description | Input Data | | | Expected Output | Actual Output | Status | Comments |
| | | a | b | C | | | | |
| WN1 /SN1 | Enter the nom value for a , b and c | 5 | 5 | 5 | Should display the message Equilateral triangle | | | |
| WN2 /SN2 | Enter the min value for a , b and c | 2 | 2 | 3 | Should display the message Isosceles triangle | | | |
| WN3 /SN3 | Enter the min value for a , b and c | 3 | 4 | 5 | Should display the message Scalene triangle | | | |
| WN4 /SN4 | Enter the min value for a , b and c | 4 | 1 | 2 | Message should be displayed can't form a triangle | | | |

| Weak Robust Equivalence Class Testing | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WR1 | Enter one invalid input and two valid value for a , b and c | -1 | 5 | 5 | Should display value of a is not in the range of permitted values | | | |
| WR2 | Enter one invalid input and two valid value for a , b and c | 5 | -1 | 5 | Should display value of b is not in the range of permitted values | | | |
| WR3 | Enter one invalid input and two valid value for a , b and c | 5 | 5 | -1 | Should display value of c is not in the range of permitted values | | | |
| WR4 | Enter one invalid input and two valid value for a , b and c | 11 | 5 | 5 | Should display value of a is not in the range of permitted values | | | |
| WR5 | Enter one invalid input and two valid value for a , b and c | 5 | 11 | 5 | Should display value of b is not in the range of permitted values | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WR6 | Enter one invalid input and two valid value for a , b and c | 5 | 5 | 11 | Should display value of c is not in the range of permitted values | | | |

**Strong Robust Equivalence class Testing**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SR1 | Enter one invalid input and two valid value for a , b and c | -1 | 5 | 5 | Should display value of a is not in the range of permitted values | | | |
| SR2 | Enter one invalid input and two valid value for a , b and c | 5 | -1 | 5 | Should display value of b is not in the range of permitted values | | | |
| SR3 | Enter one invalid input and two valid value for a , b and c | 5 | 5 | -1 | Should display value of c is not in the range of permitted values | | | |
| SR4 | Enter two invalid input and one valid value for a , b and c | -1 | -1 | 5 | Should display value of a is not in the range of permitted values | | | |
| | | | | | Should display value of b is not in the range of permitted values | | | |
| SR5 | Enter two invalid input and one valid value for a , b and c | 5 | -1 | -1 | Should display value of b is not in the range of permitted values | | | |
| | | | | | Should display value of c is not in the range of permitted values | | | |
| SR6 | Enter two invalid input and one valid value for a , b and c | -1 | 5 | -1 | Should display value of a is not in the range of permitted values | | | |
| | | | | | Should display value of c is not in the range of permitted values | | | |
| SR7 | Enter all invalid inputs | -1 | -1 | -1 | Should display value of a is not in the range of permitted values | | | |
| | | | | | Should display value of b is not in the range of permitted values | | | |
| | | | | | Should display value of c is not in the range of permitted values | | | |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | ✓ |

## Test Case Name :Decision table for triangle problem

## Experiment Number : 7

**Test Data : Enter the 3 Integer Value( a , b And c )**
**Pre-condition : a < b + c , b < a + c and c < a + b**
**Brief Description : Check whether given value for a equilateral, isosceles , Scalene triangle or can't form a triangle**

**Input data decision Table**

| **RULES** | | **R1** | **R2** | **R3** | **R4** | **R5** | **R6** | **R7** | **R8** | **R9** | **R10** | **R11** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conditions** | C1: a < b + c | F | T | T | T | T | T | T | T | T | T | T |
| | C2 : b < a + c | - | F | T | T | T | T | T | T | T | T | T |
| | C3 : c < a + b | - | - | F | T | T | T | T | T | T | T | T |
| | C4 : a = b | - | - | - | T | T | T | T | F | F | F | F |
| | C5 : a = c | - | - | - | T | T | F | F | T | T | F | F |
| | C6 : b = c | - | - | - | T | F | T | F | T | F | T | F |
| **Actions** | a1 : Not a triangle | X | X | X | | | | | | | | |
| | a2 : Scalene triangle | | | | | | | | | | | X |
| | a3 : Isosceles triangle | | | | | | | X | | X | X | |
| | a4 : Equilateral triangle | | | | X | | | | | | | |
| | a5 : Impossible | | | | | X | X | | X | | | |

**Triangle Problem -Decision Table Test cases for input data**

| Case Id | Description | Input Data | | | Expected Output | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|---|
| | | a | b | c | | | | |
| 1 | Enter the value of a, b and c Such that a is not less than sum of two sides | 20 | 5 | 5 | Message should be displayed can't form a triangle | | | |
| 2 | Enter the value of a, b and c Such that b is not less than sum of two sides and a is less than sum of other two sides | 3 | 15 | 11 | Message should be displayed can't form a triangle | | | |
| 3 | Enter the value of a, b and c Such that c is not less than sum of two sides and a and b is less than sum of other two sides | 4 | 5 | 20 | Message should be displayed can't form a triangle | | | |
| 4 | Enter the value a, b and c satisfying precondition and a=b, b=c and c=a | 5 | 5 | 5 | Should display the message Equilateral triangle | | | |
| 5 | Enter the value a ,b and c satisfying precondition and a=b and b ≠ c | 10 | 10 | 9 | Should display the message Isosceles triangle | | | |
| 6 | Enter the value a, b and c satisfying precondition and a ≠b , b ≠ c and c ≠ a | 5 | 6 | 7 | Should display the message Scalene triangle | | | |

## Program 1

**/* Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results. */**

**/* Assumption price for lock=45.0, stock=30.0 and barrels=25.0, production limit that could be sold in a month is 70 locks, 80 stocks and 90 barrels. Commission on sales = 10 % on sales <= 1000 and 15 % on 1001 to 1800 and 20 % on above 1800*/**

```
#include<stdio.h>
int main()
{
        Int locks, stocks, barrels, tlocks, tstocks, tbarrels;
        float lprice, sprice, bprice, sales, comm;
        int c1,c2,c3,temp;
        lprice=45.0;
        sprice=30.0;
        bprice=25.0;
        tlocks=0;
        tstocks=0;
        tbarrels=0;
        printf("\n enter the number of locks and to exit the loop enter -1 for locks\n");
        scanf("%d", &locks);
        while (locks! = -1)
        {
            c1= (locks<=0 || locks>70);
            printf("enter the number of stocks and barrels\n");
            scanf("%d%d", &stocks, &barrels);
            c2=(stocks<=0 || stocks>80);
            c3=(barrels<=0 || barrels>90);
            if(c1)
                printf("value of locks not in the range 1..70  ");
            else
            {
                temp=tlocks+locks;
                if(temp>70)
                    printf("new total locks =%d not in the range 1..70 ", temp);
                else
                     tlocks=temp;
            }
             printf("total locks = %d\n", tlocks);

             if(c2)
                printf("value of stocks not in the range 1..80  ");
             else
             {
                temp=tstocks+stocks;
```

```
                    if(temp>80)
printf("new total stocks =%d  not in the range 1..80 ", temp);

                     else
                             tstocks=temp;
              }
              printf("total stocks=%d\n", tstocks);

              if(c3)
                   printf("value of barrels not in the range 1..90  ");
     else
                {
                     temp=tbarrels+barrels;
                     if(temp>90)
                               printf("new total barrels =%d not in the range 1..90 ", temp);
                     else
                                tbarrels=temp;
                  }
              printf("total barrels=%d", tbarrels);
              printf("\n enter the number of locks and to exit the loop enter -1 for locks \n");
              scanf("%d", &locks);
     }
     printf("\n total locks = %d\n total stocks =%d\n total barrels =%d\n", tlocks, tstocks, tbarrels);
     sales = lprice*tlocks + sprice*tstocks + bprice*tbarrels;
     printf("\n the total sales=%f\n", sales);
     if(sales > 0)
     {
           if(sales > 1800.0)
           {
                comm=0.10*1000.0;
                comm=comm+0.15*800;
                comm=comm+0.20*(sales-1800.0);
           }
          else if(sales > 1000)
          {
                 comm =0.10*1000;
                 comm =comm+0.15*(sales-1000.0);
          }
           else
                 comm=0.10*sales;
                  printf("the commission is=%f\n", comm);
       }
     else
            printf("there is no sales\n");
            return 0;
}
```

**Test Case Name : Boundary Value for Commission Problem**

**Experiment Number : 2**

**Test data : price for lock = 45.0 , stock = 30.0 and barrel = 25.0**
**sales = total locks * lock price + total stocks * stock price + total barrels * barrel price**
**commission : 10% up to sales Rs 1000 , 15 % for the next Rs 800 and 20 % on any sales in excess of 1800**

**Pre-condition : lock = -1 to exit and 1< =lock < = 70 , 1<=stock <=80 and 1<=barrel<=90**

**Brief Description: The salesperson had to sell at least one complete rifle per month.**

**Commission Problem Boundary Value Analysis Test Cases**

| Case Id | Description | Input Data | | | Expected Output | | Actual output | | Status | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Locks | Total Stocks | Total Barrels | Sales | Comm-ission | Sales | Comm-ission | | Comment |
| 1 | Set locks and stocks as nominal value and vary barrels value. | 35 | 40 | 1 | 2800 | | | | | |
| 2 | Set locks and stocks as nominal value and vary barrels value. | 35 | 40 | 2 | 2825 | | | | | |
| 3 | Set locks and stocks as nominal value and vary barrels value. | 35 | 40 | 45 | 3900 | | | | | |
| 4 | Set locks and stocks as nominal value and vary barrels value. | 35 | 40 | 89 | 5000 | | | | | |
| 5 | Set locks and stocks as nominal value and vary barrels value. | 35 | 40 | 90 | 5025 | | | | | |
| 6 | Set locks and barrels as nominal value and vary stocks value | 35 | 1 | 45 | 2730 | | | | | |
| 7 | Set locks and barrels as nominal value and vary stocks value | 35 | 2 | 45 | 2760 | | | | | |
| 8 | Set locks and barrels as nominal value and vary stocks value | 35 | 40 | 45 | 3900 | | | | | |
| 9 | Set locks and barrels as nominal value and vary stocks value | 35 | 79 | 45 | 5070 | | | | | |
| 10 | Set locks and barrels as nominal value and vary stocks value | 35 | 80 | 45 | 5100 | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Set stocks and barrels as nominal value and vary locks value | 1 | 40 | 45 | 2370 | | | | | |
| 12 | Set stocks and barrels as nominal value and vary locks value | 2 | 40 | 45 | 2415 | | | | | |
| 13 | Set stocks and barrels as nominal value and vary locks value | 35 | 40 | 45 | 3900 | | | | | |
| 14 | Set stocks and barrels as nominal value and vary locks value | 69 | 40 | 45 | 5430 | | | | | |
| 15 | Set stocks and barrels as nominal value and vary locks value | 70 | 40 | 45 | 5475 | | | | | |

**Commission Problem Output Boundary Value Analysis Test Cases**

| Case Id | Description | Input Data | | | Expected Output | | Actual output | | Status | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Locks | Total Stocks | Total Barrels | Sales | Comm-ission | Sales | Comm-ission | | Comment |
| 1 | Enter the min value for locks, stocks and barrels | 1 | 1 | 1 | 100 | 10 | | | | output minimum |
| 2 | Enter the min value for 2 items and min +1 for any one item | 1 | 1 | 2 | 125 | 12.5 | | | | output minimum + |
| 3 | | 1 | 2 | 1 | 130 | 13 | | | | output minimum + |
| 4 | | 2 | 1 | 1 | 145 | 14.5 | | | | output minimum + |
| 5 | Enter the value sales approximately mid value between 100 to 1000 | 5 | 5 | 5 | 500 | 50 | | | | Midpoint |
| 6 | Enter the values to calculate the commission for sales nearly less than 1000 | 10 | 10 | 9 | 975 | 97.5 | | | | Border point - |
| 7 | | 10 | 9 | 10 | 970 | 97 | | | | Border point - |
| 8 | | 9 | 10 | 10 | 955 | 95.5 | | | | Border point - |
| 9 | Enter the values sales exactly equal to 1000 | 10 | 10 | 10 | 1000 | 100 | | | | Border point |
| 10 | | 10 | 10 | 11 | 1025 | 103.75 | | | | Border point + |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Enter the values to calculate the commission for sales nearly greater than 1000 | 10 | 11 | 10 | 1030 | 104.5 | | | | Border point + |
| 12 | | 11 | 10 | 10 | 1045 | 106.75 | | | | Border point + |
| 13 | Enter the value sales approximately mid value between 1000 to 1800 | 14 | 14 | 14 | 1400 | 160 | | | | Midpoint |
| 14 | Enter the values to calculate the commission for sales nearly less than 1800 | 18 | 18 | 17 | 1775 | 216.25 | | | | Border point - |
| 15 | | 18 | 17 | 18 | 1770 | 215.5 | | | | Border point - |
| 16 | | 17 | 18 | 18 | 1755 | 213.25 | | | | Border point - |
| 17 | Enter the values sales exactly equal to 1800 | 18 | 18 | 18 | 1800 | 220 | | | | Border point |
| 18 | Enter the values to calculate the commission for sales nearly greater than 1800 | 18 | 18 | 19 | 1825 | 225 | | | | Border point + |
| 19 | | 18 | 19 | 18 | 1830 | 226 | | | | Border point + |
| 20 | | 19 | 18 | 18 | 1845 | 229 | | | | Border point + |
| 21 | Enter the value sales approximately mid value between 1800 to 7800 | 48 | 48 | 48 | 4800 | 820 | | | | Midpoint |
| 22 | Enter the max value for 2 items and max - 1 for any one item | 70 | 80 | 89 | 7775 | 1415 | | | | Output maximum - |
| 23 | | 70 | 79 | 90 | 7770 | 1414 | | | | Output maximum - |
| 24 | | 69 | 80 | 90 | 7755 | 1411 | | | | Output maximum - |
| 25 | Enter the max value for locks, stocks and barrels | 70 | 80 | 90 | 7800 | 1420 | | | | Output maximum |

**Output Special Value Test Cases**

| Case Id | Description | Input Data | | | Expected Output | | Actual output | | Status | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total Locks | Total Stocks | Total Barrels | Sales | Comm-ission | Sales | Comm -ission | | |
| 1 | Enter the random values such that to calculate commission for sales nearly less than 1000 | 11 | 10 | 8 | 995 | 99.5 | | | | Border point - |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Enter the random values such that to calculate commission for sales nearly greater than 1000 | 10 | 11 | 9 | 1005 | 100.75 | | | | Border point + |
| 3 | Enter the random values such that to calculate commission for sales nearly less than 1800 | 18 | 17 | 19 | 1795 | 219.25 | | | | Border point - |
| 4 | Enter the random values such that to calculate commission for sales nearly greater than 1800 | 18 | 19 | 17 | 1805 | 221 | | | | Border point + |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | ✓ |

**Program 3 Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.**

**/* Assumption price for lock=45.0, stock=30.0 and barrels=25.0, production limit that could be sold in a month is 70 locks, 80 stocks and 90 barrels. Commission on sales = 10 % on sales <= 1000 and 15 % on 1001 to 1800 and 20 % on above 1800*/**

```
#include<stdio.h>
int main()
{
Int locks, stocks, barrels, tlocks, tstocks, tbarrels;
float lprice, sprice, bprice, sales, comm;
int c1,c2,c3,temp;
lprice=45.0;
sprice=30.0;
bprice=25.0;
tlocks=0;
tstocks=0;
tbarrels=0;
printf("\n enter the number of locks and to exit the loop enter -1 for locks\n");
scanf("%d", &locks);
while (locks! = -1)
      {
c1= (locks<=0 || locks>70);
printf("enter the number of stocks and barrels\n");
scanf("%d%d", &stocks, &barrels);
c2=(stocks<=0 || stocks>80);
c3=(barrels<=0 || barrels>90);
if(c1)
                printf("value of locks not in the range 1..70  ");
else
```

```
 {
 temp=tlocks+locks;
 if(temp>70)
 printf("new total locks =%d not in the range 1..70 ", temp);
 else
tlocks=temp;
 }
 printf("total locks = %d\n", tlocks);

if(c2)
 printf("value of stocks not in the range 1..80  ");
 else
 {
 temp=tstocks+stocks;
 if(temp>80)
 printf("new total stocks =%d  not in the range 1..80 ", temp);
 else
 tstocks=temp;
 }
 printf("total stocks=%d\n", tstocks);

 if(c3)
 printf("value of barrels not in the range 1..90  ");
 else
   {
 temp=tbarrels+barrels;
 if(temp>90)
 printf("new total barrels =%d not in the range 1..90 ", temp);
 else
 tbarrels=temp;
   }
```

```
printf("total barrels=%d", tbarrels);
printf("\n enter the number of locks and to exit the loop enter -1 for locks \n");
scanf("%d", &locks);
}
printf("\n total locks = %d\n total stocks =%d\n total barrels =%d\n", tlocks, tstocks, tbarrels);
sales = lprice*tlocks + sprice*tstocks + bprice*tbarrels;
printf("\n the total sales=%f\n", sales);
if(sales > 0)
{
if(sales > 1800.0)
{
comm=0.10*1000.0;
comm=comm+0.15*800;
     comm=comm+0.20*(sales-1800.0);
}
else if(sales > 1000)
{
comm =0.10*1000;
comm =comm+0.15*(sales-1000.0);
}
else
comm=0.10*sales;
 printf("the commission is=%f\n", comm);
        }
else
printf("there is no sales\n");
return 0;
}
```

## Test Case Name :Decision Table for Commission Problem

## Experiment Number : 3

**Test data :** price for lock = 45.0 , stock = 30.0 and barrel = 25.0
sales = total locks * lock price + total stocks * stock price + total barrels * barrel price
commission : 10% up to sales Rs 1000 , 15 % of the next Rs 800 and 20 % on any sales in excess of 1800

**Pre-condition :** lock = -1 to exit and 1< =lock < = 70 , 1<=stock <=80 and 1<=barrel<=90

**Brief Description:** The salesperson had to sell at least one complete rifle per month.

### Input data decision Table

| RULES | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Conditions | C1: Locks = -1 | T | F | F | F | F | F | F | F | F |
| | C2 : 1 ≤ Locks ≤ 70 | - | T | T | F | T | F | F | F | T |
| | C3 : 1 ≤ Stocks ≤ 80 | - | T | F | T | F | T | F | F | T |
| | C4 : 1 ≤ Barrels ≤ 90 | - | F | T | T | F | F | T | F | T |
| Actions | A1 : Terminate the input loop | X | | | | | | | | |
| | A2 : Invalid locks input | | | | X | | X | X | X | |
| | A3 : Invalid stocks input | | | X | | X | | X | X | |
| | A4 : Invalid barrels input | | X | | | X | X | | X | |
| | A5 : Calculate total locks, stocks and barrels | | X | X | X | X | X | X | | X |
| | A6: Calculate Sales | X | | | | | | | | |
| | A7: proceed to commission decision table | X | | | | | | | | |

### Commission calculation Decision Table (Precondition : lock = -1)

| RULES | | R1 | R2 | R3 | R4 |
|---|---|---|---|---|---|
| Conditions | C1 : Sales = 0 | T | F | F | F |
| | C2 : Sales > 0 AND Sales ≤ 1000 | | T | F | F |
| | C3 : Sales > 1000 AND sales ≤ 1800 | | | T | F |
| | C4 : sales >1800 | | | | T |
| Actions | A1 : Terminate the program | X | | | |
| | A2 : comm= 10%*sales | | X | | |
| | A3 : comm = 10%*1000 + (sales-1000)*15% | | | X | |
| | A4 : comm = 10%*1000 + 15% * 800 + (sales-1800)*20% | | | | X |

**Precondition : Initial Value Total Locks= 0 , Total Stocks=0 and Total Barrels=0**

**Precondition Limit :Total locks, stocks and barrels should not exceed the limit 70,80 and 90 respectively**

**Commission Problem -Decision Table Test cases for input data**

| Case Id | Description | Input Data | | | Expected Output | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Locks | Stocks | Barrels | | | | |
| 1 | Enter the value of Locks= -1 | -1 | | | Terminate the input loop check for sales if(sales=0) exit from program else calculate commission | | | |
| 2 | Enter the valid input for locks and stocks and invalid for barrels | 20 | 30 | -5 | Total of locks, stocks is updated if it is within a precondition limit and Should display value of barrels is not in the range 1..90 | | | |
| 3 | Enter the valid input for locks and barrrels and invalid for stocks | 15 | -2 | 45 | Total of locks, barrels is updated if it is within a precondition limit and Should display value of stocks is not in the range 1..80 | | | |
| 4 | Enter the valid input for stocks and barrrels and invalid for locks | -4 | 15 | 16 | Total of stocks , barrels is updated if it is within a precondition limit and Should display value of locks is not in the range 1..70 | | | |
| 5 | Enter the valid input for locks and invalid value for stocks and barrels | 15 | 81 | 100 | Total of locks is updated if it is within a precondition limit and **(i)**Should display value of stock is not in the range 1..80 **(ii)**Should display value of barrels is not in the range 1..90 | | | |
| 6 | Enter the valid input for stocks and invalid value for locks and barrels | 88 | 20 | 99 | Total of stocks is updated if it is within a precondition limit and **(i)**Should display value of lock is not in the range 1..70 **(ii)**Should display value of barrels is not in the range 1..90 | | | |
| 7 | Enter the valid input for barrels and invalid value for locks and stocks | 100 | 200 | 25 | Total of barrels is updated if it is within a precondition limit and **(i)**Should display value of lock is not in the range 1..70 **(ii)**Should display value of stocks is not in the range 1..80 | | | |
| 8 | Enter the invalid input for lock , stocks and barrels | -5 | 400 | -9 | **(i)**Should display value of lock is not in the range 1..70 **(ii)**Should display value of stocks is not in the range 1..80 **(iii)**Should display value of barrel in not in the range 1..90 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | Enter the valid input for lock, stocks and barrels | 15 | 20 | 25 | Total of locks,stocks and barrels is updated if it is within a precondition limit and calculate the sales and proceed to commission | | | |

### Commission Problem -Decision Table Test cases for commission calculation

**Precondition : Locks = -1**

| Case Id | Description | Input Data | Expected Output | | Actual Output | Status | Comments |
|---|---|---|---|---|---|---|---|
| | | Sales | Commission | Values | | | |
| 1 | Check the value of sales | 0 | Terminate the program where commission is zero | 0 | | | |
| 2 | if sales value within these range( Sales >0 AND Sales ≤ 1000 ) | 900 | Then commission = 0.10*sales | 90 | | | |
| 3 | if sales value within these range( Sales > 1000 AND Sales ≤  1800 ) | 1400 | Then commission = 0.10*1000 + 0.15*(sales - 1000) | 160 | | | |
| 4 | if sales value within these range( Sales > 1800 | 2500 | Then commission = 0.10*1000 + 0.15*800 + 0.20 *(sales - 1800) | 340 | | | |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | ✓ |

## Program 2

**Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.**

```
#include<stdio.h>
int check (int day, int month)
{
if((month==4||month==6||month==9 ||month==11) && day==31)
 return 1;
else
 return 0;
}

int isleap(int year)
{
if((year%4==0 && year%100!=0) || year%400==0)
 return 1;
else
 return 0;
}

int main()
{
int day, month, year, tomm_day, tomm_month, tomm_year;
char flag;
do
{
 flag='y';
 printf("\nenter the today's date in the form of dd mm yyyy\n");
 scanf("%d%d%d", &day, &month, &year);
 tomm_month=month;
 tomm_year= year;
  if(day<1 || day>31)
  {
   printf("value of day, not in the range 1...31\n");
    flag='n';
  }
  if(month<1 || month>12)
  {
  printf("value of month, not in the range 1....12\n");
  flag='n';
  }
 else if(check(day, month))
          {
           printf("value of day, not in the range day<=30");
           flag='n';
           }

 if(year<1812 || year>2017)
 {
    printf("value of year, not in the range 1812.......2017\n");
    flag='n';
 }
```

```
if(month==2)
  {
      if(isleap(year) && day>29)
       {
        printf("invalid date input for leap year");
        flag='n';
       }
         else if(!(isleap(year))&& day>28)
         {
          printf("invalid date input for not a leap year");
          flag='n';
         }
  }
} while(flag=='n');

switch (month)
{
case 1:
case 3:
case 5:
case 7:
case 8:
case 10:if(day<31)
 tomm_day=day+1;
 else
    {
    tomm_day=1;
     tomm_month=month+1;
    }
 break;

case 4:
case 6:
case 9:
case 11: if(day<30)
 tomm_day=day+1;
  else
     {
    tomm_day=1;
    tomm_month=month+1;
     }
 break;

case 12: if(day<31)
 tomm_day=day+1;
 else
    {
     tomm_day=1;
     tomm_month=1;
  if(year= =2017)
   {
     printf("the next day is out of boundary value of year\n");
    }


    else
```

```
       tomm_year=year+1;
    }
 break;
 case 2:
 if(day<28)
    tomm_day=day+1;
 else if(isleap(year)&& day==28)
    tomm_day=day+1;
 else if(day==28 || day==29)
    {
       tomm_day=1;
       tomm_month=3;
    }
 break;
}
printf("next day is : %d  %d  %d", tomm_day, tomm_month, tomm_year);
return 0;
}
```

## Test Case Name : Equivalence class test cases for NextDate

## Experiment Number :6

**Test data :** Enter the three integer value

**Pre-condition :** Month 1 to 12 , DAY 1 TO 31 & YEAR 1812 TO 2017

**Valid Classes**

M1 = { month ; 1 ≤ month ≤ 12 }
D1 = { day : 1 ≤ day ≤ 31 }
Y1 = { year : 1812 ≤ year ≤ 2017 }

**Invalid Classes**

M2 = {month : month < 1}
M3 = {month : month > 12}
D2 = {day : day < 1}
D3 = {day : day > 31}
Y2 = {year : year < 1812}
Y3 = {year : year >2017}

**NextDate Equivalence Class Testing**

**( Weak and Strong Normal Equivalence Class )**

| Case Id | Description | Input Data | | | Expected Output | | | Actual output | | | Status | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | month | day | year | month | day | year | month | day | year | | |
| WN1,SN1 | Enter the valid value for month, day and year | 6 | 15 | 1915 | 6 | 16 | 1915 | | | | | |

### ( Weak Robustness Equivalence Class )

| Case Id | Description | Input Data | | | Expected Output | | | Actual output | | | Status | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | month | day | year | month | day | year | month | day | year | | |
| WR1 | Enter the valid value for month, day and year | 6 | 15 | 1915 | 6 | 16 | 1915 | | | | | |
| WR2 | Enter the invalid value for month and valid value for day and year | -1 | 15 | 1915 | Should display the message value of the month not in the range 1..12 | | | | | | | |
| WR3 | Enter the invalid value for month and valid value for day and year | 13 | 15 | 1915 | Should display the message value of the month not in the range 1..12 | | | | | | | |
| WR4 | Enter the invalid value for day and valid value for month and year | 6 | -1 | 1915 | Should display the message value of the day not in the range 1..31 | | | | | | | |
| WR5 | Enter the invalid value for day and valid value for month and year | 6 | 32 | 1915 | Should display the message value of the day not in the range 1..31 | | | | | | | |
| WR6 | Enter the invalid value for year and valid value for month and day | 6 | 15 | 1811 | Should display the message value of the year not in the range 1812..2017 | | | | | | | |
| WR7 | Enter the invalid value for year and valid value for month and day | 6 | 15 | 2018 | Should display the message value of the year not in the range 1812..2017 | | | | | | | |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | ✓ |

**(Strong Robustness Equivalence Class )**

| Case Id | Description | Input Data | | | Expected Output | Actual Output | Status | Comment |
|---|---|---|---|---|---|---|---|---|
| | | month | day | year | | | | |
| SR1 | Enter the invalid value for month and valid value for day and year | -1 | 15 | 1915 | Should display the message value of the month not in the range 1..12 | | | |
| SR2 | Enter the invalid value for day and valid value for month and year | 6 | -1 | 1915 | Should display the message value of the day not in the range 1..31 | | | |
| SR3 | Enter the invalid value for year and valid value for month and day | 6 | 15 | 1811 | Should display the message value of the year not in the range 1812..2017 | | | |
| SR4 | Enter the invalid value for month and day and valid value for year | -1 | -1 | 1915 | (i)Should display the message value of the month in range 1..12 | | | |
| | | | | | **(ii)** Should display the message value of the day in range 1..31 | | | |
| SR5 | Enter the invalid value for day and year and valid value for month | 6 | -1 | 1811 | **(i)** Should display the message value of the day in range 1..31 | | | |
| | | | | | **(ii)** Should display the message value of the year in range 1812..2017 | | | |
| SR6 | Enter the invalid value for year and month and valid value for day | -1 | 15 | 1811 | (i)Should display the message value of the month in range 1..12 | | | |
| | | | | | **(ii)** Should display the message value of the year in range 1812..2017 | | | |
| SR7 | Enter the invalid value for month, day and year | -1 | -1 | 1811 | (i)Should display the message value of the month in range 1..12 | | | |
| | | | | | **(ii)** Should display the message value of the day in range 1..31 | | | |
| | | | | | **(iii)** Should display the message value of the year in range 1812..2017 | | | |

## Some addition Equivalence Class Testcases

| Case Id | Description | Input Data | | | Expected Output | | | Actual Output | | | Status | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | day | month | year | day | month | year | day | month | year | | |
| 1 | Enter the invalid value for year valid value for day and month | 31 | 12 | 1811 | Should display the message value of the year in range 1812..2017 | | | | | | | |
| 2 | Enter the valid value for month, day and year | 31 | 12 | 2016 | 1 | 1 | 2017 | | | | | |
| 3 | Enter the valid value for month, day and year | 28 | 2 | 2000 | 29 | 2 | 2000 | | | | | |
| 4 | Enter the valid value for month, day and year | 28 | 2 | 1996 | 29 | 2 | 1996 | | | | | |
| 5 | Enter the valid value for month, day and year | 29 | 2 | 2000 | 1 | 3 | 2000 | | | | | |
| 6 | Enter the valid value for month, day and year | 29 | 2 | 1996 | 1 | 3 | 1996 | | | | | |
| 7 | Enter the valid value for month, day and year | 28 | 2 | 2002 | 1 | 3 | 2002 | | | | | |
| 8 | Enter the valid value for month, day and year | 29 | 2 | 2002 | Invalid I/P Date | | | | | | | |
| 9 | Enter the invalid value for year valid value for day and month | 31 | 12 | 2018 | | | | | | | | |

**5. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.**

```
#include<stdio.h>
int main()
{
   int locks, stocks, barrels, tlocks, tstocks, tbarrels;
float lprice, sprice, bprice, lsales, ssales, bsales, sales, comm;
lprice =45.0;
sprice=30.0;
bprice=25.0;
tlocks=0;
tstocks=0;
tbarrels=0;
                printf("\nenter the number of locks and to exit the loop enter -1 for locks\n");
scanf("%d",&locks);
while(locks!= -1){
                printf("enter the number of stocks and barrels\n");
scanf("%d%d",&stocks, &barrels);
         tlocks = tlocks + locks;
tstocks = tstocks + stocks;
         tbarrels = btarrels + barrels;
                printf("\n enter the number of locks and to exit the loop enter -1 for locks\n");
scanf("%d", &locks);
  }
printf("\n total locks = %d\”, tlocks);
printf(“total stocks =%d\n”, tstocks);
printf(“total barrels =%d\n", tbarrels);

lsales = lprice*tlocks;
ssales = sprice*tstocks;
bsales = bprice*tbarrels;
sales = lsales + ssales + bsales;
printf("\n the total sales=%f\n", sales);
if(sales > 1800.0)
{
comm=0.10*1000.0;
comm=comm+0.15*800;
comm=comm+0.20*(sales-1800.0);
                }
else if(sales > 1000)
{
comm =0.10*1000;
comm=comm+0.15*(sales-1000);
  }
else
{ comm=0.10*sales;
   }
printf" \n value of commission is\n");
   printf("the commission is=%f\n", comm);
return 0;  }
```

**Define /Use nodes for variables in the commission problem**

| Variable name | Defined at node | Used at Node |
|---|---|---|
| lprice | 7 | 24 |
| sprice | 8 | 25 |
| bprice | 9 | 26 |
| tlocks | 10,16 | 16, 21, 24 |
| tstocks | 11,17 | 17, 22, 25 |
| tbarrels | 12,18 | 18, 23, 26 |

| | | |
|---|---|---|
| locks | 13,19 | 14,16 |
| stocks | 15 | 17 |
| barrels | 15 | 18 |
| lsales | 24 | 27 |
| ssales | 25 | 27 |
| bsales | 26 | 27 |
| sales | 27 | 28, 29, 33, 34, 37, 39 |
| comm | 31, 32, 33, 36, 37, 39 | 32, 33, 37, 42 |

### Selected Define/Use Paths for Commission problem

| Test case id | Description | Variables Path(Beginning, End nodes) | Du Paths | Definition clear? | Comments |
|---|---|---|---|---|---|
| 1 | Check for lock price variable **DEF(lprice,7)** and **USE(lprice,24)** | (7 , 24) | <7-8-9-10-11-12-13-14-15-16-17-18-19-20-14-21-22-23-24> | Yes | |
| 2 | Check for Stock price variable **DEF(sprice,8)** and **USE(sprice,25)** | (8 , 25) | <8-9-10-11-12-13-14-15-16-17-18-19-20-14-21-22-23-24-25> | Yes | |
| 3 | Check for barrel price variable **DEF(bprice,9)** and **USE(bprice,26)** | (9 , 26) | <9-10-11-12-13-14-15-16-17-18-19-20-14-21-22-23-24-25-26> | Yes | |
| 4 | Check for total locks variable **DEF(tlocks,10) and DEF(tlocks,16)** and **3 usage nodes USE(tlocks,16), USE(tlocks,21), USE(tlocks,24)** | (10 , 16) | <10-11-12-13-14-15-16> | Yes | |
| | | (10 , 21) | <10-11-12-13-14-15-16-17-18-19-20-14-21> | No | |
| | | (10 , 24) | <10-11-12-13-14-15-16-17-18-19-20-14-21-22-23-24> | No | |
| | | (16 , 16) | <16-16> | Yes | |
| | | (16 , 21) | <16-17-18-19-14-21> | No | |
| | | (16 , 24) | <16-17-18-19-20-14-21-22-23-24> | No | |
| 5 | Check for total stocks **variable DEF(tstocks,11) and DEF(tstocks,17)** and **3 usage nodes (USE(tstocks,17), USE(tstocks,22), USE(tstocks,25)** | (11 , 17) | <11-12-13-14-15-16-17> | Yes | |
| | | (11 , 22) | <11-12-13-14-15-16-17-18-19-20-14-21-22> | No | |
| | | (11, 25) | <11-12-13-14-15-16-17-18-19-20-14-21-22-23-24-25> | No | |
| | | (17 , 17) | <17-17> | Yes | |
| | | (17 , 22) | <17-18-19-20-14-21-22> | No | |
| | | (17 , 25) | <17-18-19-20-14-21-22-23-24-25> | No | |

| | | | | | |
|---|---|---|---|---|---|
| 6 | check for locks variable<br>**DEF(locks,13), DEF(locks,19)**<br>**and USE(locks,14), USE(locks,16)** | (13 , 14) | <13-14> | Yes | Begin the loop |
| | | ( 13 , 16) | <13-14-15-16> | Yes | |
| | | (19 , 14) | <19-20-14> | Yes | |
| | | (19 , 16) | <19-20-14-15-16> | Yes | Repeat the loop |
| 7 | Check for stocks variable **(DEF(stocks,15)**<br>and **USE(stocks,17)** | (15 , 17) | <15-16-17> | Yes | |
| 8 | Check for sales  variable **DEF(sales, 27)** and<br>**USE(Sales, 28), USE(Sales , 29), USE(Sales,33) ,**<br>**USE(Sales , 34) , USE(Sales,37) , USE(Sales , 39)** | (27 ,28) | <27-28> | Yes | |
| | | (27 , 29) | <27-28-29> | Yes | |
| | | (27 , 33) | <27-28-29-30-31-32-33> | Yes | |
| | | (27 , 34) | <27-28-29-34> | Yes | |
| | | (27 , 37) | <27-28-29-34-35-36-37> | Yes | |
| | | (27 , 39) | <27-28-29-34-38-39> | Yes | |
| 9 | Check for Commission variable<br>**DEF(comm, 31,32,33) , DEF(comm,36,37) and DEF(comm,39)** and **USE(comm,42)** | ((31,32,33),42) | <31-32-33-42> | Yes | |
| | | ((36 , 37) , 42) | <36-37-42> | Yes | |
| | | (39 , 42 ) | <39 - 42> | Yes | |

## Program 6

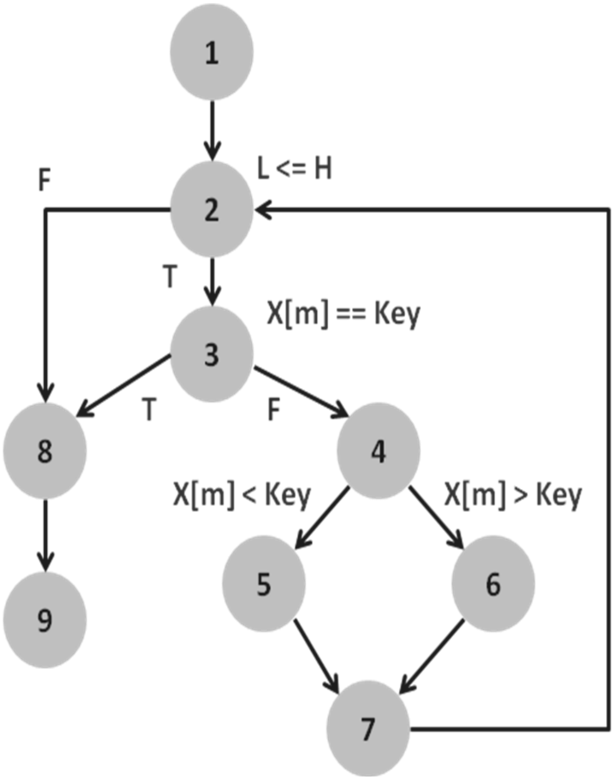
**/* Design,develop a code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases execute these test cases and discuss the test results */**

```
#include<stdio.h>
int binsrc(int x[],int low,int high,int key)
{
int mid;
while(low<=high)
{
 mid=(low+high)/2;
 if(x[mid]==key)
 return mid;
 if(x[mid]<key)
 low=mid+1;
 else
 high=mid-1;
}
return -1;
}

int main()
{
int a[20],key,i,n,succ;
printf("Enter the n value");
scanf("%d",&n);
if(n>0)
{
printf("enter the elements in ascending order\n");
 for(i=0;i<n;i++)
 scanf("%d",&a[i]);

printf("enter the key element to be searched\n");
        scanf("%d",&key);
 succ=binsrc(a,0,n-1,key);
 if(succ>=0)
 printf("Element found in position = %d\n",succ+1);
 else
 printf("Element not found \n");
}
else
 printf("Number of element should be greater than zero\n");
return 0;
}
```

## Binary Search function with line number

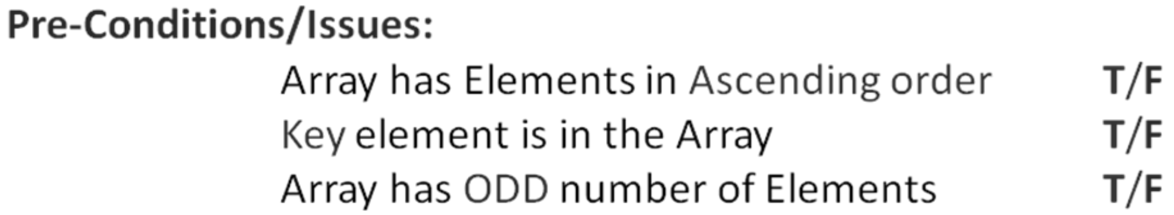
```
int binsrc(int x[],int low, int high, int key)
{
int mid;  1
while(low<=high) 2
 {
 mid=(low+high)/ 2;
 if(x[mid]==key) 3
 return mid; 8
 if(x[mid]<key) 4
 low=mid+1; 5
 else
 high=mid-1;          6
}                                   7
return -1;                          8
}                                    9
```

## Program Graph – for Binary Search



**Independent Paths:**
#Edges=11, #Nodes=9, #P=1
**V(G)**= E-N+2P = 11-9+2 = **4**

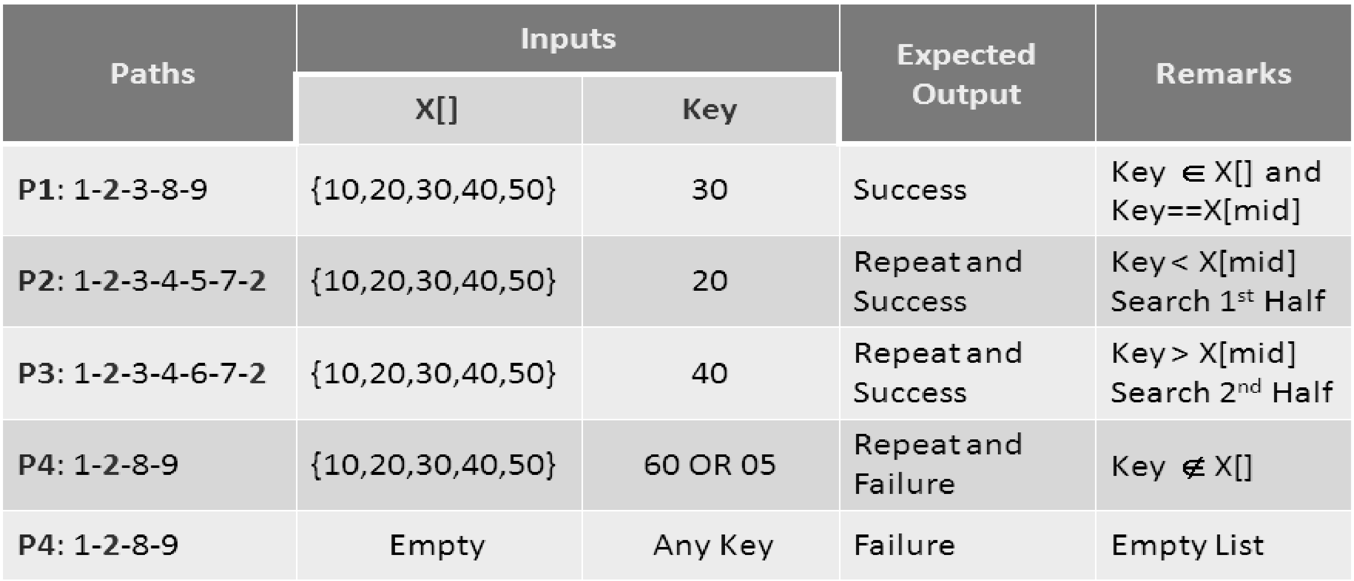
**P1**: 1-**2**-3-8-9
**P2**: 1-**2**-3-4-5-7-**2**
**P3**: 1-**2**-3-4-6-7-**2**
**P4**: 1-**2**-8-9



**Pre-Conditions/Issues:**

| | |
|---|---|
| Array has Elements in Ascending order | **T/F** |
| Key element is in the Array | **T/F** |
| Array has ODD number of Elements | **T/F** |

**Test Cases – Binary Search**



| Paths | Inputs | | Expected Output | Remarks |
|---|---|---|---|---|
| | X[] | Key | | |
| **P1**: 1-2-3-8-9 | {10,20,30,40,50} | 30 | Success | Key ∈ X[] and Key==X[mid] |
| **P2**: 1-2-3-4-5-7-2 | {10,20,30,40,50} | 20 | Repeat and Success | Key < X[mid] Search 1st Half |
| **P3**: 1-2-3-4-6-7-2 | {10,20,30,40,50} | 40 | Repeat and Success | Key > X[mid] Search 2nd Half |
| **P4**: 1-2-8-9 | {10,20,30,40,50} | 60 OR 05 | Repeat and Failure | Key ∉ X[] |
| **P4**: 1-2-8-9 | Empty | Any Key | Failure | Empty List |