Assignment 1

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Problem 1

Problem Analysis :

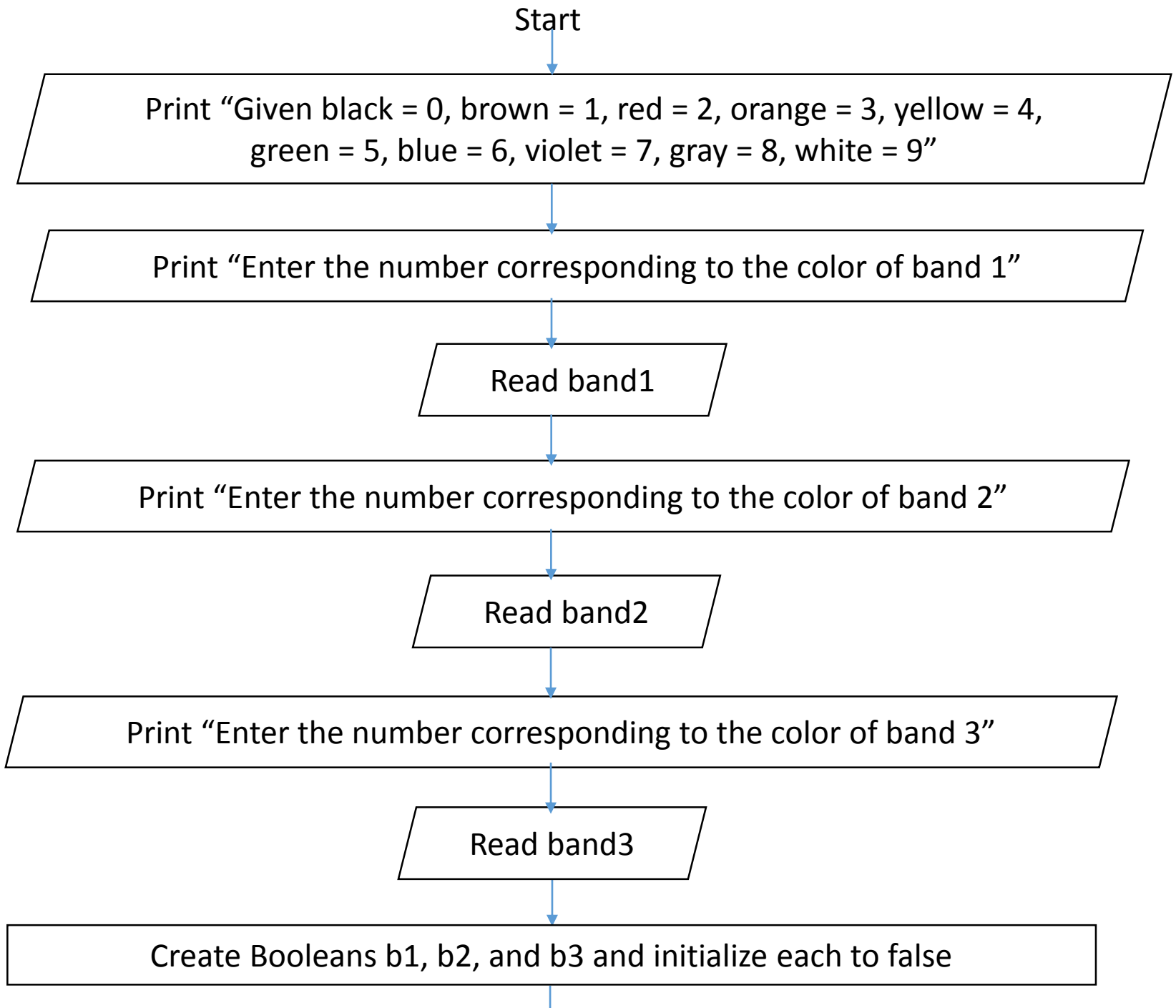
Task: To print resistance in ohms given 3 numbers corresponding to colors of 3 bands on resistor.

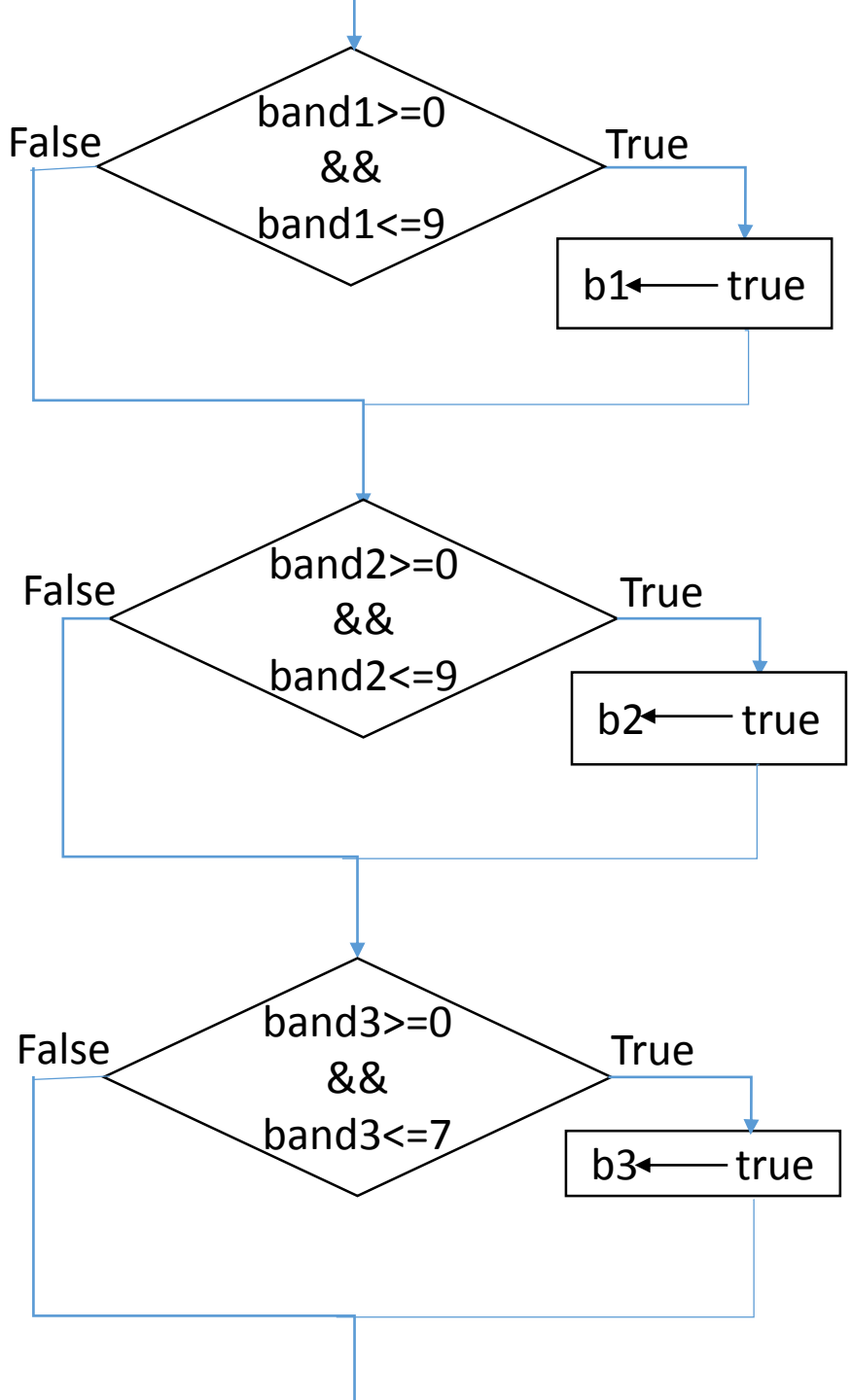
- Inputs – The inputs are three numbers corresponding to the colors of the three bands on the resistor. These numbers are stored in variables band1, band2 and band3.

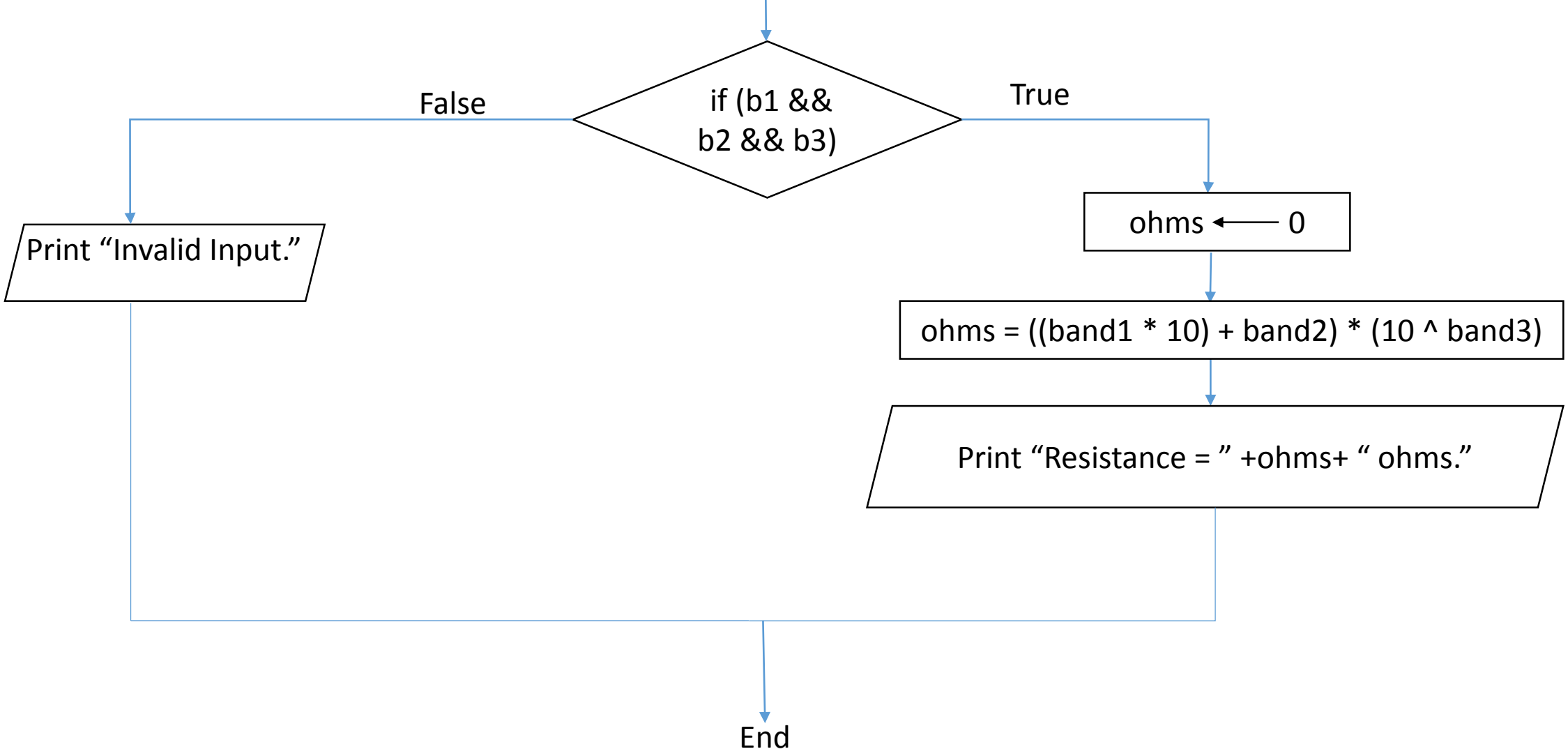
- Output – The output is the resistance value of the resistor in ohms, which is stored in variable named ohms. Output is calculated using the equation ohms = ((band1 * 10) + band2) * (10 ^ band3). Output is printed as “Resistance = ” +ohms+ “ ohms.”

- Error conditions – Booleans b1, b2 and b3 are initialized to false. If band1 and band2 lie in the valid range of 0 to 9 then b1 and b2 become true. If band3 lies in the valid range of 0 to 7 then b3 becomes true. The condition if(b1 && b2 && b3) is used to check if all the Booleans are true. If even one Boolean is false that means that the user has entered invalid input. Therefore the error message “Invalid Input.” is printed on the screen.

Flow Chart :


Start
Print “Given black = 0, brown = 1, red = 2, orange = 3, yellow = 4, green = 5, blue = 6, violet = 7, gray = 8, white = 9”
Print “Enter the number corresponding to the color of band 1”
Read band1
Print “Enter the number corresponding to the color of band 2”
Read band2
Print “Enter the number corresponding to the color of band 3”
Read band3
Create Booleans b1, b2, and b3 and initialize each to false


band1>=0
&&
band1<=9
False
True
b1 ← true
band2>=0
&&
band2<=9
False
True
b2 ← true
band3>=0
&&
band3<=7
False
True
b3 ← true


if (b1 &&
b2 && b3)
False
True
Print “Invalid Input.”
ohms ← 0
ohms = ((band1 * 10) + band2) * (10 ^ band3)
Print “Resistance = ” +ohms+ “ ohms.”
End

Test cases :

1. //Three valid numbers
Input: 2
3
4
Output: Resistance = 230000 ohms.

2. //Three invalid numbers
Input: 11.3
-8
100
Output: Invalid Input.

3. //Three equal numbers
Input: 2
2
2
Output: Resistance = 2200 ohms.

4. //First number invalid
Input: 42
8
6
Output: Invalid Input.

5. //Second number invalid
Input: 0
19
7
Output: Invalid Input.

6. //Third number invalid
Input: 3
2
8909
Output: Invalid Input.

7. //Any combination of two invalid numbers
Input: 53.7
4
-89
Output: Invalid Input.

8. //To show use 0 as third number
Input: 1
2
0
Output: Resistance = 12 ohms.

9. //To show use of 8 (gray) for third input is invalid
Input: 1
2
8
Output: Invalid Input.

10. //To show use of 9 (white) for third input is invalid
Input: 3
5
9
Output: Invalid Input.

Problem 2

Problem Analysis :

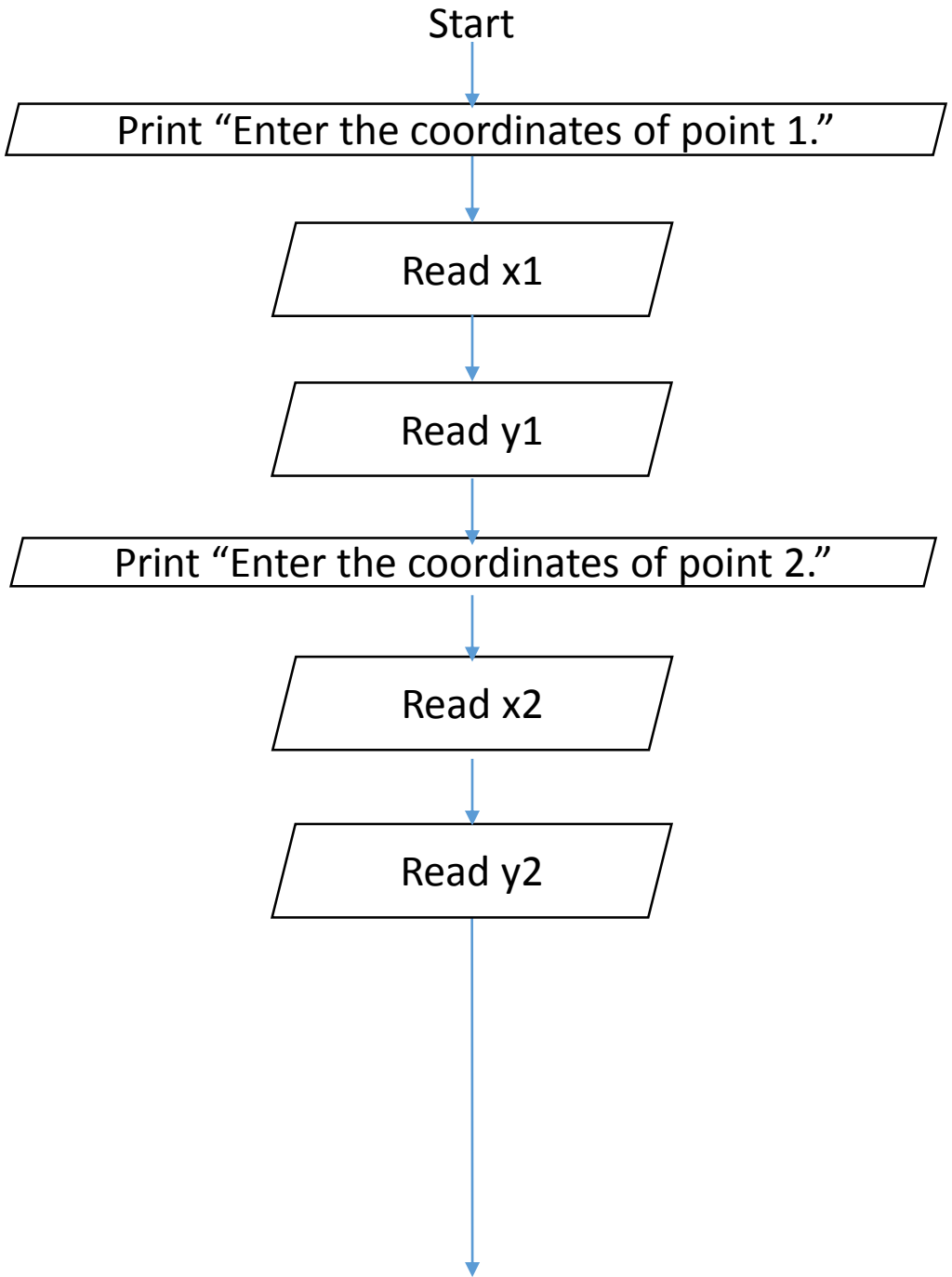
Task: To print the equation of the line passing through two points given their coordinates.

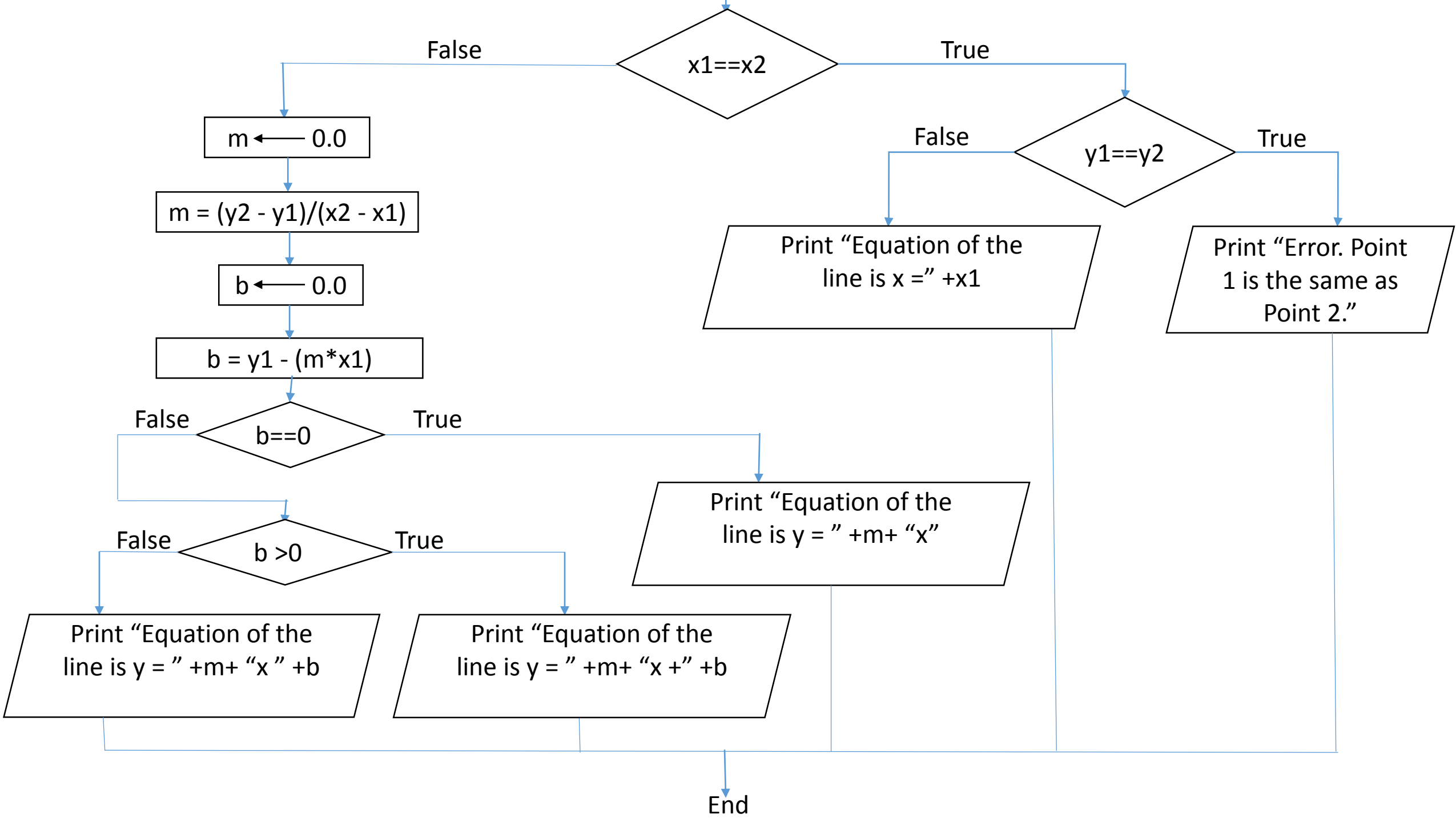
- Inputs – The inputs are the coordinates of point 1 and point 2. The x and y coordinate of point 1 are stored in variables x1 and y1 respectively. The x and y coordinate of point 2 are stored in variables x2 and y2 respectively.

- Output – The output is the equation of the line passing through both points. The equation is calculated using slope-intercept form, where m is slope and b is y-intercept. When x coordinates are equal but y coordinates are unequal, the equation takes the form x = x1. If b is equal to 0, it is not printed in output “y = ”+m+ “x”.
  If b is positive we print “y = ”+m+ “x +” +b. If b is negative we must omit the addition sign before the last closed-inverted comma and print “y = ”+m+“x ”+b.

- Error conditions – Check if x1 == x2 and if y1 == y2. If the coordinates of both points are equal, print “Error. Point 1 is the same as Point 2.”

Flow Chart :


Start
Print “Enter the coordinates of point 1.”
Read x1
Read y1
Print “Enter the coordinates of point 2.”
Read x2
Read y2


x1==x2
False
True
y1==y2
False
True
Print “Equation of the line is x =” +x1
Print “Error. Point 1 is the same as Point 2.”
m ← 0.0
m = (y2 - y1)/(x2 - x1)
b ← 0.0
b = y1 - (m*x1)
b==0
False
True
Print “Equation of the line is y = ” +m+ “x”
b >0
False
True
Print “Equation of the line is y = ” +m+ “x ” +b
Print “Equation of the line is y = ” +m+ “x +” +b
End

Test cases :

1. //All four coordinates are unequal
Input: 40.0
10.0
30.0
5.0
Output: Equation of the line is y = 0.5x -10.0

2. //Coordinates involving negative numbers
Input: 73.2
-10.6
35.7
52.9
Output: Equation of the line is y = -1.69333333x +113.352

3. //x coordinates are equal but y coordinates are not
Input: 100.0
80.6
100.0
67.4
Output: Equation of the line is x = 100.0

4. //x coordinates are equal and y coordinates are equal
Input: 50.01
30.28
50.01
30.28
Output: Error. Point 1 is the same as Point 2.

5. //y coordinates are equal but x coordinates are not
Input: 10.6
25.5
130.0
25.5
Output: Equation of the line is y = 0.0x +25.5

6. //one point is the origin
Input: 10.6
31.8
0.0
0.0
Output: Equation of the line is y = 3.0x

Problem 3

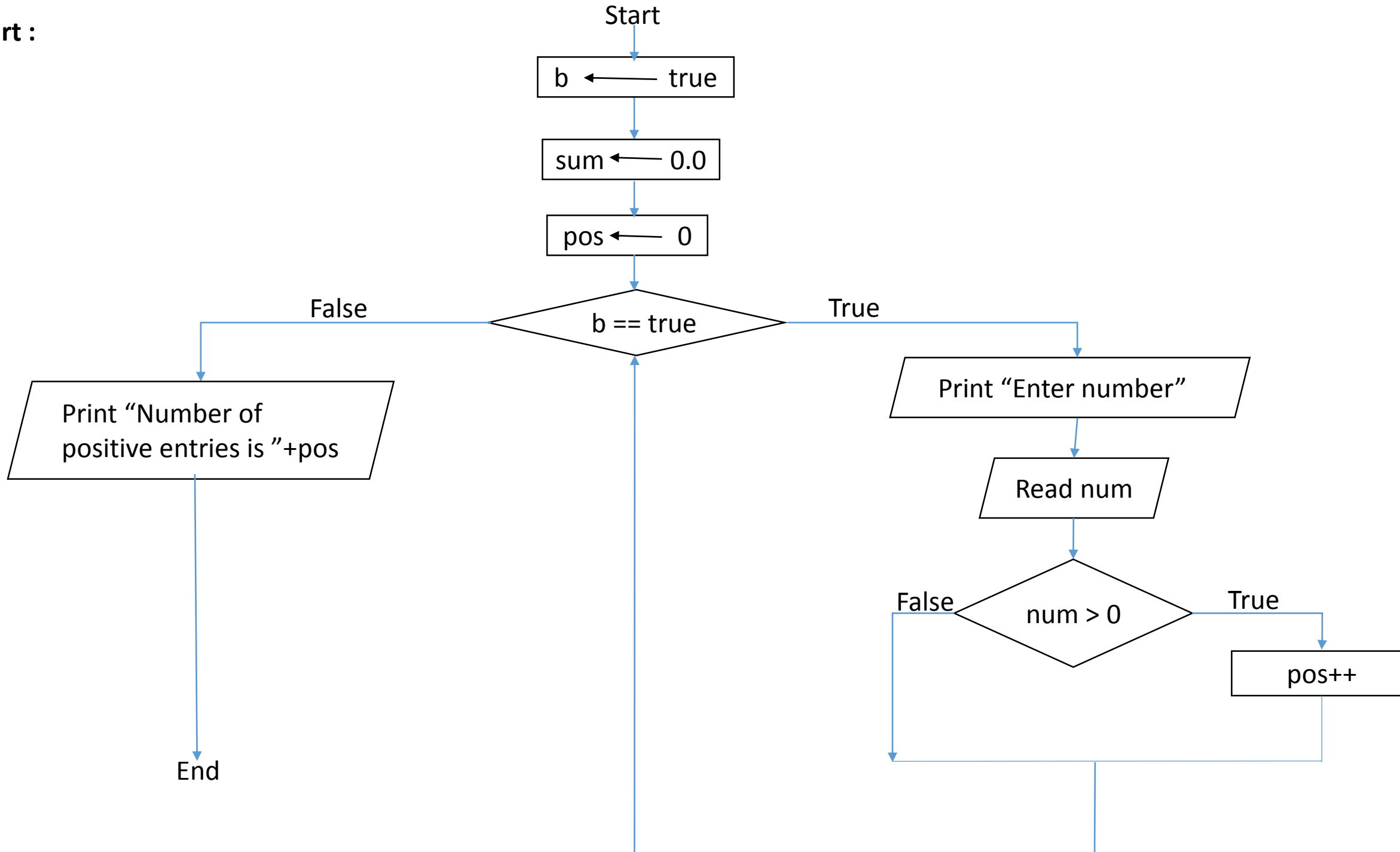
Problem Analysis :

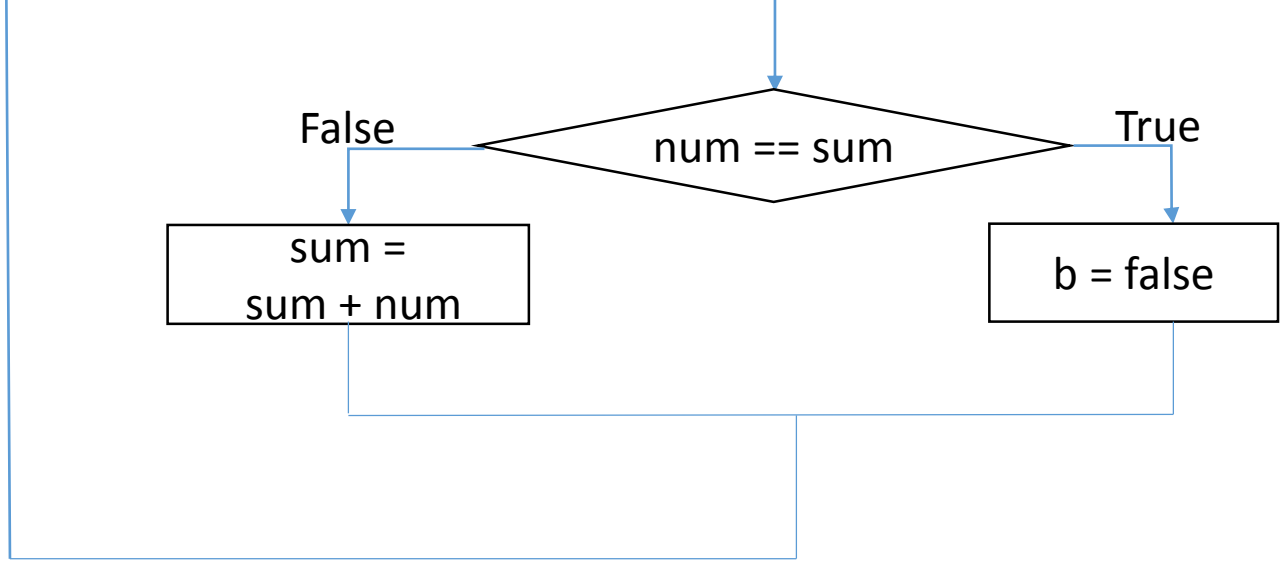
Task: To print the number of positive entries given a sequence of numbers when the recent input is the sum of the previous inputs.

- Inputs – The user inputs numbers one at a time. Input is stored in variable num.

- Output – When the most recently entered number is the sum of all previously entered numbers, the program outputs the number of positive entries stored in variable pos. The output is printed as “Number of positive entries is ”+pos

Flow Chart :


Start
b ← true
sum ← 0.0
pos ← 0
b == true
False
True
Print “Number of positive entries is ”+pos
End
Print “Enter number”
Read num
num > 0
False
True
pos++


num == sum
False
True
sum =
sum + num
b = false

Test cases :

1. //Zero is non-positive.

Input: 2.0
10.0
-8.0
0.0
4.0

Output: Number of positive entries is 3

2. //Some numbers are repeated

Input: 6.0
100.0
20.3
-18.8
6.0
113.5

Output: Number of positive entries is 5

3. //Entering 0 as first input

Input: 0.0

Output: Number of positive entries is 0