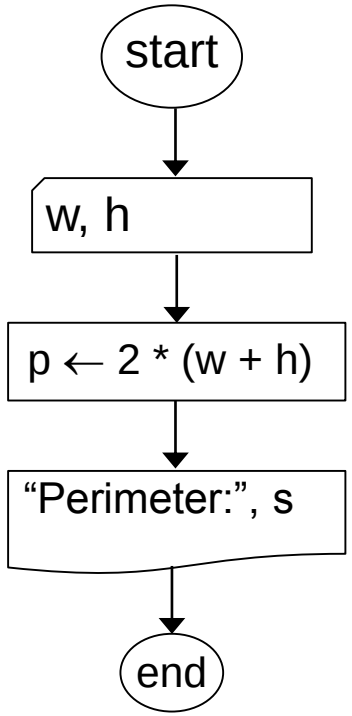
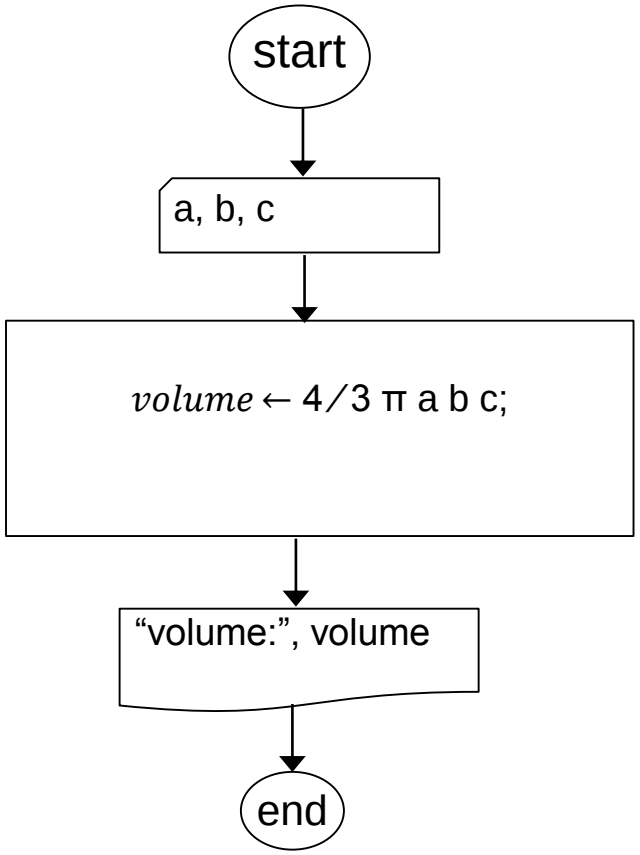
Ex 1 Sample Solution




```
function perimeter() {
    //precondition
    //num1 and num2 represent real numbers
    //postcondition
    //perimeter of a rectangle with sides num1 and num 2 is outputted

  var w=parseInt(document.getElementById("num1").value);
  var h=parseInt(document.getElementById("num2").value);

  var p = 2 * (w + h);

  document.getElementById("output").innerHTML="perimeter: "+p;

}
```

pre-con.: w, h ∈ ℝ
post-con.: perimeter is outputted

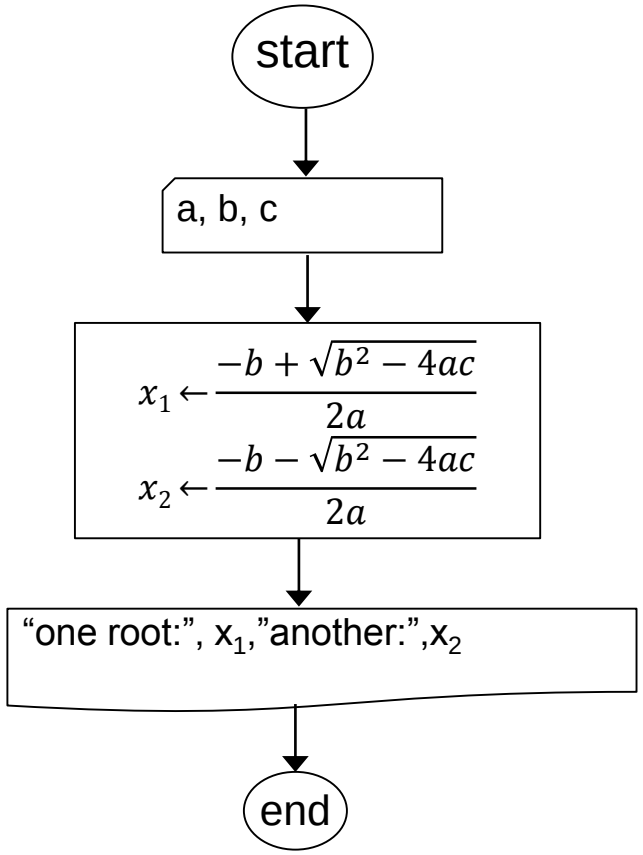
Ex 2 Sample Solution



pre-con.: a, b, c ∈ ℝ and qualify for semi-axes of an ellipsoid
post-con.: volume of an ellipsoid with semi-axes a, b, c is outputted

```
function volume() {
    //precondition
    //num1, num2, and num3 represent real numbers
    //postcondition
    //volume of an ellipsoid with semi-axes num1, num2, and num3 is outputted
  var a=parseInt(document.getElementById("num1").value);
  var b=parseInt(document.getElementById("num2").value);
  var c=parseInt(document.getElementById("num3").value);

  var volume = 4/3 * Math.PI * a * b * c;
  document.getElementById("output").innerHTML="volume: " + volume.toFixed(2);
}
```

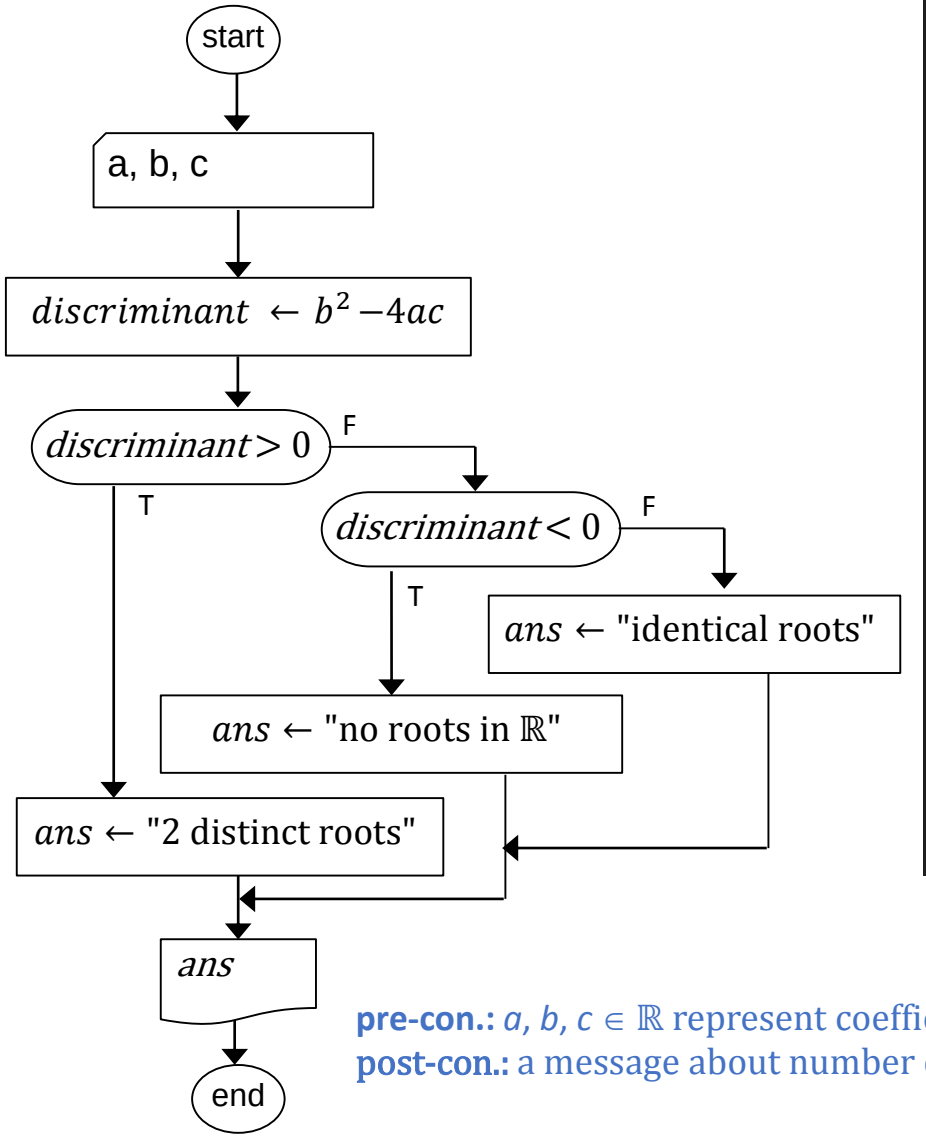
Ex 3 Sample Solution



pre-con.: $a, b, c \in \mathbb{R}$ represent coefficients of a quadratic equation and $b^2 \geq 4ac$
post-con.: roots of the quadratic equation is outputted

```
function equation() {
    //Precondition:
    //num1, num2, num3 represent coefficients of a quadratic equation.
    //and num2 ^ 2 >= 4 * num1 * num3. num1 <> 0
    //Postcondition:
    //The roots of the equation are outputted
  var a = parseInt(document.getElementById("num1").value);
  var b = parseInt(document.getElementById("num2").value);
  var c = parseInt(document.getElementById("num3").value);
  var x1 = (-b + Math.sqrt(b * b - 4 * a * c)) / (2 * a);
  var x2 = (-b - Math.sqrt(b * b - 4 * a * c)) / (2 * a);

  document.getElementById("output").innerHTML="one root: "+x1.toFixed(2)+"<br>"
                                              +"another: "+x2.toFixed(2);
}
```

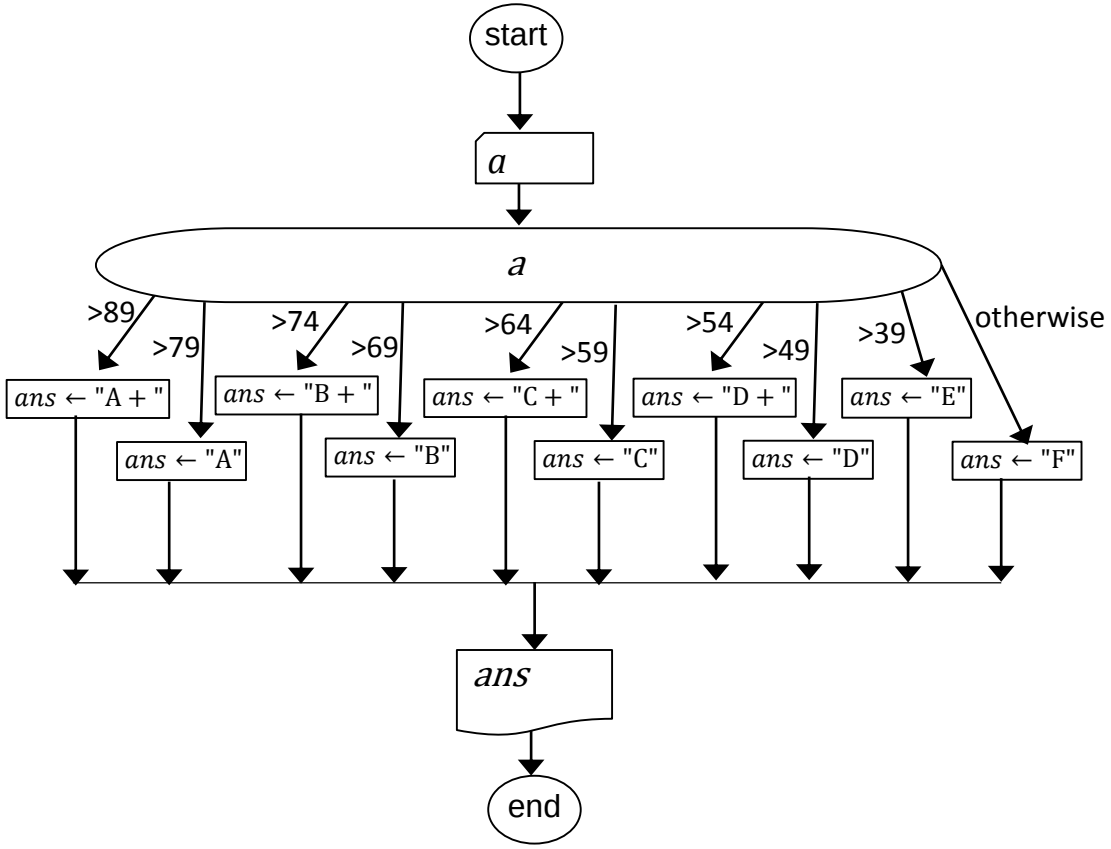
Ex 4 Sample Solution




```javascript
function equation() {
  //precondition:
  //  num1, num2, num3 represent coefficients of a quadratic equation. num1 <> 0
  //Postcondition:
  //  A message for whether the equation has two roots, one root, or no root is outputted

  var a = parseInt(document.getElementById("num1").value);
  var b = parseInt(document.getElementById("num2").value);
  var c = parseInt(document.getElementById("num3").value);

  var discriminant = b * b - 4 * a * c;

  if (discriminant > 0) {
    var answer = "it has 2 distict roots";
  }
  else if (discriminant < 0) {
    var answer = "it has no roots in real numbers";
  }
  else {
    var answer = "its roots are identical";
  }

  document.getElementById("output").innerHTML = answer;

}
```

pre-con.: $a, b, c \in \mathbb{R}$ represent coefficients of a quadratic equation
post-con.: a message about number of roots in $\mathbb{R}$ is outputted

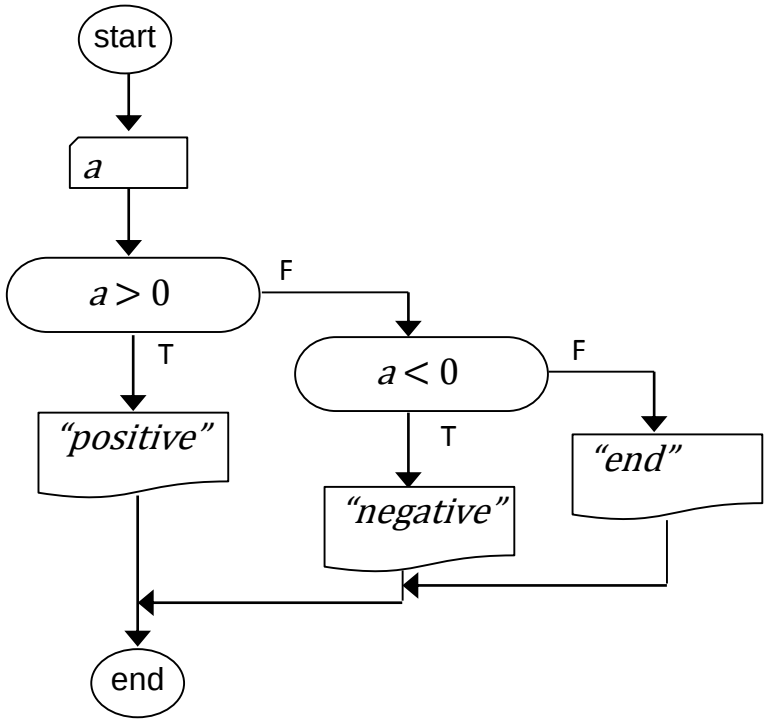
Ex 5 Sample Solution



pre-con.: $a \in \mathbb{R}$ in the range $[0, 100]$
post-con.: a letter grade according to the mapping is outputted

```
function mapping() {
  //precondition:
  //  num1 represents a Real number
  //Postcondition:
  //  The mapping of num1 to a letter grade has been outputted

  var a = parseInt(document.getElementById("num1").value);

  switch (true) {
    case (a > 89): answer = "A+"; break;
    case (a > 79): answer = "A"; break;
    case (a > 74): answer = "B+"; break;
    case (a > 69): answer = "B"; break;
    case (a > 64): answer = "C+"; break;
    case (a > 59): answer = "C"; break;
    case (a > 54): answer = "D+"; break;
    case (a > 49): answer = "D"; break;
    case (a > 39): answer = "E";  break;
    default: answer = "F";
  }

  document.getElementById("output").innerHTML = answer;
}
```

Ex 6 Sample Solution



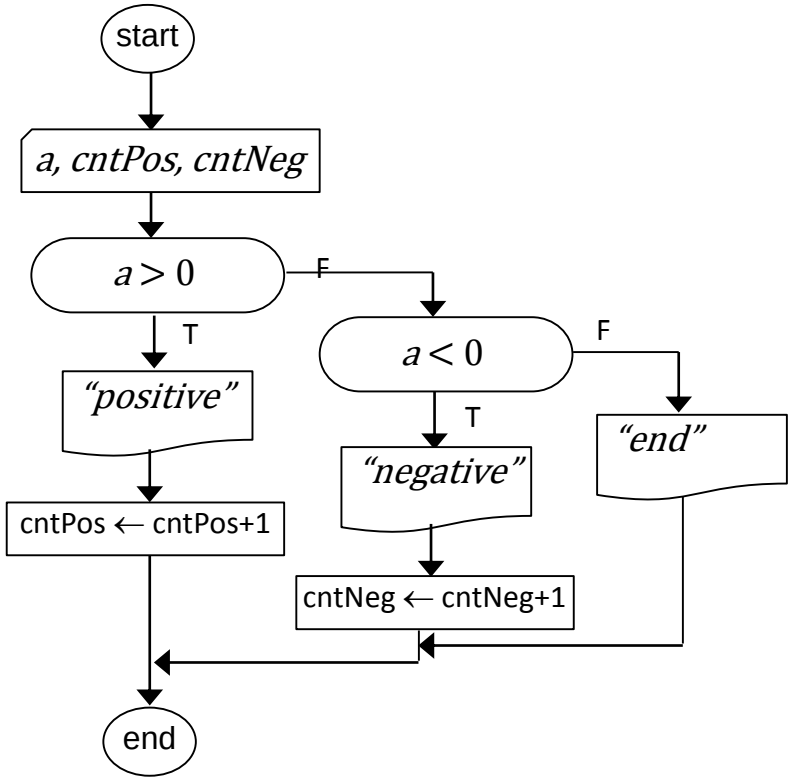
pre-con.: $a \in \mathbb{R}$

post-con.: whether a is positive or negative is outputted. If $a = 0$, the caller is disabled

```
function problem06() {
    //precondition:
    // num1 represents a Real number
    //Postcondition:
    // Whether num1 is positive or negative is outputted. If num1=0, program ends

    var a = parseFloat(document.getElementById("num1").value);

    if (a > 0) {
        document.getElementById("output").innerHTML = "positive";
    }
    else if (a < 0) {
        document.getElementById("output").innerHTML = "negative";
    }
    else {
        document.getElementById("output").innerHTML = "program ended";
        document.getElementById("num1").setAttribute("disabled", "true");
        document.getElementsByTagName("button")[0].setAttribute("disabled", "true");
    }
}
```

Note: In this implementation, we have used the features of web programming and event-driven programming to satisfy the requirements (no loops)

Ex 7 Sample Solution

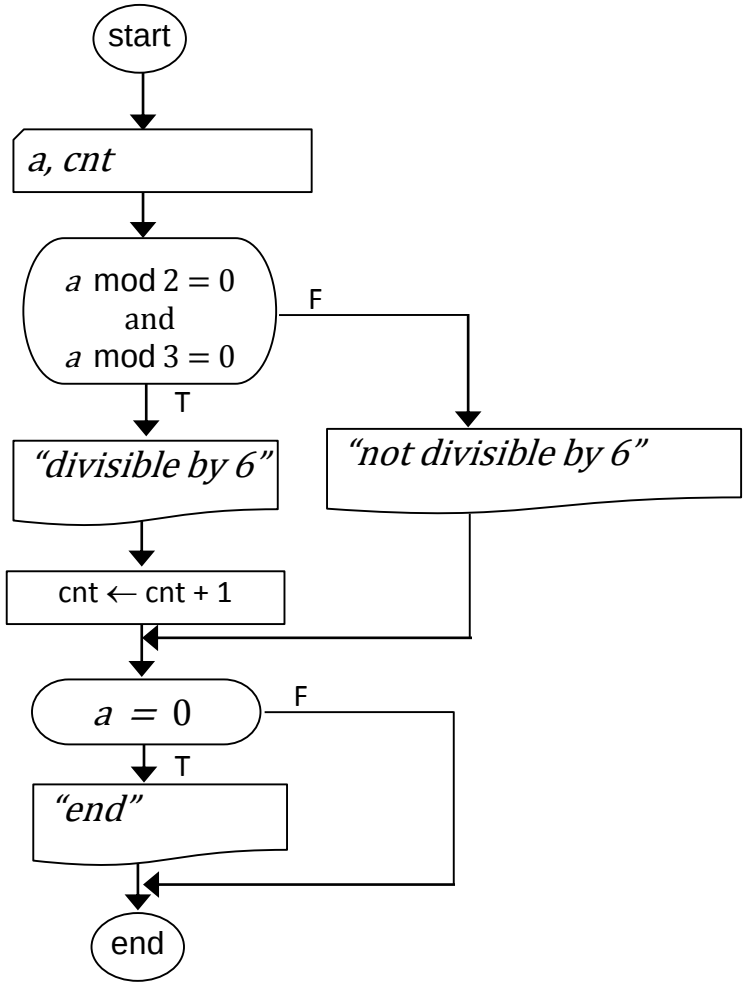


pre-con.: $a \in \mathbb{R}$, *cntPos* and *cntNeg* represent the counts of positive and negative numbers so far
post-con.: whether a is positive or negative is outputted and the counter is updated. If $a = 0$, the caller is disabled

```
function problem07() {
   //precondition:   num1 represents a Real number
   //Postcondition:  the counts of postive and negative numbers is outputted.
   //                If num1=0, program ends

   var a = parseFloat(document.getElementById("num1").value);

   if (a > 0) {
      document.getElementById("output").innerHTML = "positive";
      var cnt = parseFloat(document.getElementById("positives_counter").innerHTML);
      cnt = cnt + 1;
      document.getElementById("positives_counter").innerHTML = cnt;
   }
   else if (a < 0) {
      document.getElementById("output").innerHTML = "negative";
      var cnt = parseFloat(document.getElementById("negatives_counter").innerHTML);
      cnt = cnt + 1;
      document.getElementById("negatives_counter").innerHTML = cnt;
   }
   else {
      document.getElementById("output").innerHTML = "program ended";
      document.getElementById("num1").setAttribute("disabled", "true");
      document.getElementsByTagName("button")[0].setAttribute("disabled", "true");
      document.getElementById("ex_7").style.display = "inline";
   }
}
```

Note: In this implementation, we have used the features of web programming and event-driven programming to satisfy the requirements (no loops)

Ex 8 Sample Solution

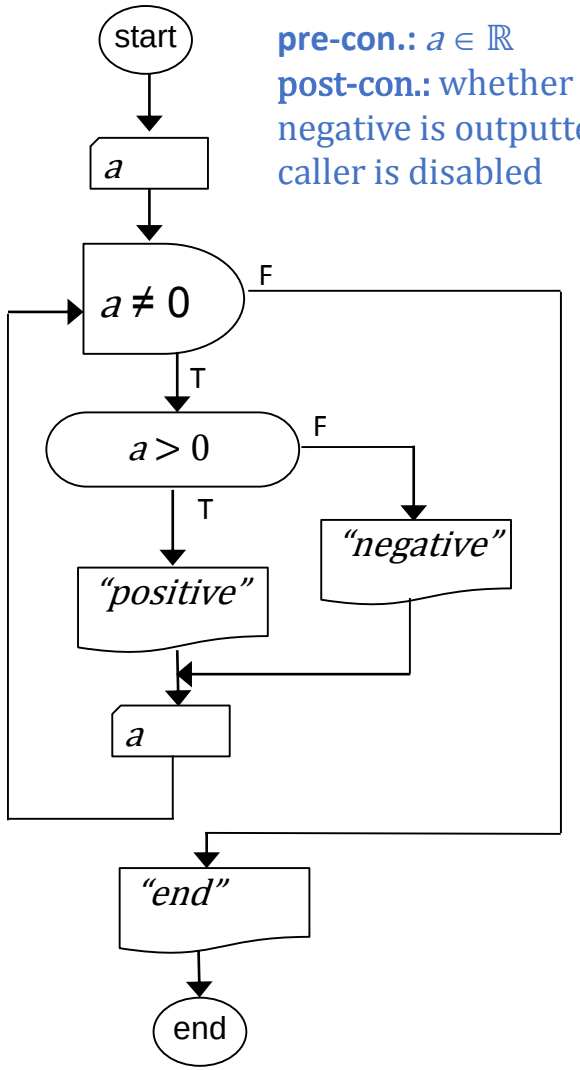


pre-con.: $a \in \mathbb{R}$, *cnt* denotes the current count for numbers divisible by 6
post-con.: whether a is divisible by 6 or not is updated. If $a = 0$, the caller is disabled

```
function problem08() {
    //precondition:
    //  num1 represents a Real number
    //Postcondition:
    //  the count of numbers divisible by 6 is outputted

    var a = parseFloat(document.getElementById("num1").value);

    if ((a % 2 == 0) && (a % 3 == 0)) {
        document.getElementById("output").innerHTML = "yes, this is divisible by 6";
        var cnt = parseFloat(document.getElementById("divBy6").innerHTML);
        cnt = cnt + 1;
        document.getElementById("divBy6").innerHTML = cnt;
    }
    else {
        document.getElementById("output").innerHTML = "this is not divisible by 6";
    }
    if (a == 0) {
        document.getElementById("output").innerHTML = "program ended";
        document.getElementById("num1").setAttribute("disabled", "true");
        document.getElementsByTagName("button")[0].setAttribute("disabled", "true");
        document.getElementById("ex_8").style.display = "inline";
    }
}
```

Note: In this implementation, we have used the features of web programming and event-driven programming to satisfy the requirements (no loops)

Ex 6 A sample solution **using loops**



pre-con.: $a \in \mathbb{R}$
post-con.: whether a is positive or negative is outputted. If $a = 0$, the caller is disabled

```
function problem06v2() {
    //precondition: num1 is in Real number
    //Postcondition: Whether num1 is positive or negative is outputted.
    //                If num1=0, program ends
    var a = parseFloat(prompt("Please enter a number: ", ""));

    while (a != 0) {
        if (a > 0) {
            document.getElementById("output").innerHTML = "positive";
        }
        else {
            document.getElementById("output").innerHTML = "negative";
        }

        a = parseFloat(prompt("Please enter a number:", ""));
    }
    document.getElementById("output").innerHTML = "program ended";
    document.getElementsByTagName("button")[0].setAttribute("disabled", "true");
}
```

Extra practice: provide a solution (flowchart and JS code) using the ***do-while*** construct.

Note: using the ***for*** construct for this problem is not a good choice. Why?