SE ASSIGNMENT 06

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For this analysis, we will assume the following pseudocode which implements the logic for solving the quadratic equation problem described in Part 2.

Assumed Pseudocode

```
1.  FUNCTION check_roots(a, b, c):
2.      IF a = 0 THEN
3.          PRINT "Not a quadratic equation"
4.          RETURN
5.      ENDIF
6.      discriminant = (b*b) - (4*a*c)
7.      IF discriminant > 0 THEN
8.          PRINT "Real roots"
9.      ELSE IF discriminant = 0 THEN
10.         PRINT "Equal Roots"
11.     ELSE
12.         PRINT "Imaginary roots"
13.     ENDIF
14.     RETURN
15. END FUNCTION
```

a) Control Flow Graph (CFG)

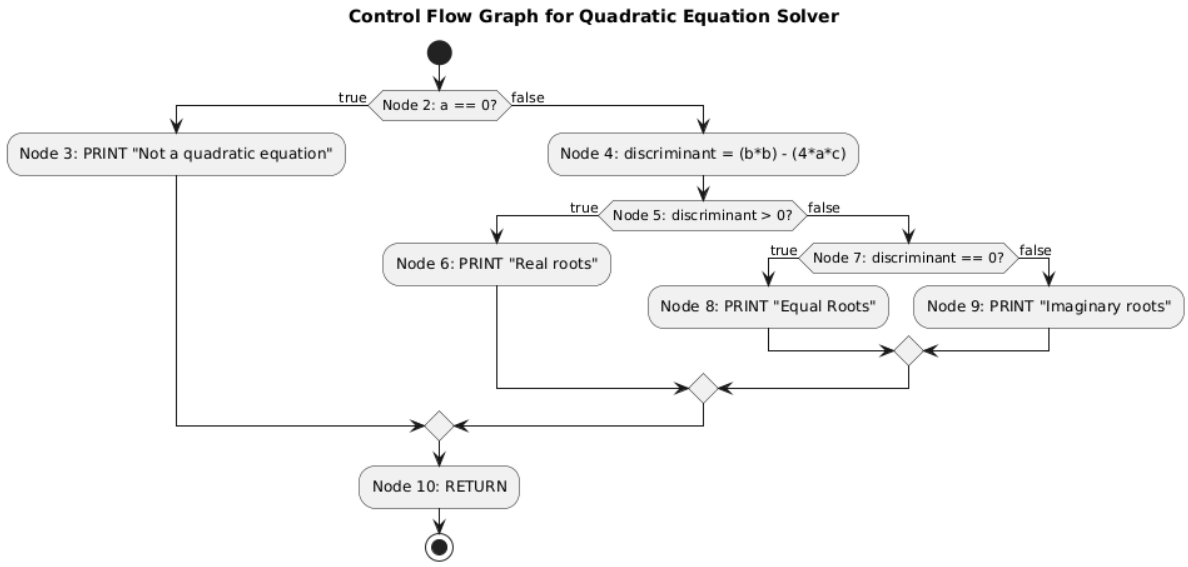
A Control Flow Graph is a directed graph that represents the flow of control or execution in a program. Each node in the graph represents a basic block (a sequence of non-branching statements), and the directed edges represent jumps in the control flow.

Nodes:

- **Node 1:** FUNCTION check_roots(a, b, c)
- **Node 2:** IF a = 0 (Predicate Node)
- **Node 3:** PRINT "Not a quadratic equation"
- **Node 4:** discriminant = (b*b) - (4*a*c)
- **Node 5:** IF discriminant > 0 (Predicate Node)
- **Node 6:** PRINT "Real roots"
- **Node 7:** ELSE IF discriminant = 0 (Predicate Node)

- **Node 8:** PRINT "Equal Roots"
- **Node 9:** PRINT "Imaginary roots"
- **Node 10:** RETURN (Exit Node)

Graphical Representation: (Generated through UML code)



b) Cyclomatic Complexity

Cyclomatic complexity, V(G), is a software metric that quantitatively measures the logical complexity of a program. It is equal to the number of independent paths through the code.

Method 1: Using Edges and Nodes V(G) = E - N + 2

- Number of Nodes (N) = 10
- Number of Edges (E) = 12
- V(G) = 12 - 10 + 2 = 4

Method 2: Using Predicate Nodes V(G) = P + 1

- Predicate nodes (nodes with more than one exit path) are Node 2, Node 5, and Node 7.
- Number of Predicate Nodes (P) = 3
- V(G) = 3 + 1 = 4

Method 3: Using Regions V(G) is the number of enclosed regions in the CFG plus one for the outer region.

- The graph has 3 enclosed regions and 1 outer region.
- V(G) = 3 + 1 = 4

Conclusion: The Cyclomatic Complexity of the given code is **4**.

c) Independent Paths

An independent path is any path through the program that introduces at least one new set of processing statements or a new condition. The number of independent paths is equal to the cyclomatic complexity.

Based on the CFG, the 4 independent paths are:

1. **Path 1 (Not a quadratic):** 1 -> 2 -> 3 -> 10
    - **Condition:** a = 0 is true.
2. **Path 2 (Real roots):** 1 -> 2 -> 4 -> 5 -> 6 -> 10
    - **Conditions:** a = 0 is false, discriminant > 0 is true.
3. **Path 3 (Equal roots):** 1 -> 2 -> 4 -> 5 -> 7 -> 8 -> 10
    - **Conditions:** a = 0 is false, discriminant > 0 is false, discriminant = 0 is true.
4. **Path 4 (Imaginary roots):** 1 -> 2 -> 4 -> 5 -> 7 -> 9 -> 10
    - **Conditions:** a = 0 is false, discriminant > 0 is false, discriminant = 0 is false