21. Using the virtual machine instructions given in Section 3.5.1.1, give an operational semantic definition of the following:

   A. Java do-while -

   ```java
   do {
       stmts;
   } while ( expr );
   ...
   ```

   **Operational semantic definition -**

   LL:

   ```
   stmts;
   if ( expr == true ) goto LL
   ```

   LO:

   ...

23. Compute the weakest precondition for each of the following assignment statements and postconditions:

   A. \(a = 2 \times (b - 1) - 1\) \{a > 0\}

   \[
   2 \times (b - 1) - 1 > 0 \Rightarrow 2 \times (b - 1) > 1 \Rightarrow 2 \times b - 2 > 1 \Rightarrow 2 \times b > 3 \Rightarrow b > 3/2
   \]

   • The weakest precondition is \{b > 3/2\}
24. Compute the weakest precondition for each of the following sequences of assignment statements and their postconditions:

A. \( a = 2 \times b + 1 \)
   \( b = a - 3 \)
   \( \{ b < 0 \} \)
   \( a - 3 < 0 \Rightarrow a < 3 \)
   \( 2 \times b + 1 < 3 \Rightarrow 2 \times b < 2 \Rightarrow b < 1 \)

- The weakest precondition is \( \{ b < 1 \} \)

25. Compute the weakest precondition for each of the following selection constructs and their postconditions:

A. if \( (a = b) \)
   \( b = 2 \times a + 1 \)
   else
   \( b = 2 \times a; \)
   \( \{ b > 1 \} \)
   \( 2 \times a + 1 > 1 \Rightarrow 2 \times a > 0 \Rightarrow a > 0 \)
   \( 2 \times a > 1 \Rightarrow a > 1/2 \)

- The weakest precondition is \( \{ a > 1/2 \} \)