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`
   b. Ada `for`
   c. C++ `if-then-else`
   d. C `for`
   e. C `switch`

22. Write a denotational semantics mapping function for the following statements:
   a. Ada `for`
   b. Java `do-while`
   c. Java Boolean expressions
   d. Java `for`
   e. C `switch`

23. Compute the weakest precondition for each of the following assignment statements and postconditions:
   a. `a = 2 * (b - 1) - 1 {a > 0}`
   b. `b = (c + 10) / 3 {b > 6}`
   c. `a = a + 2 * b - 1 {a > 1}`
   d. `x = 2 * y + x - 1 {x > 11}`

24. Compute the weakest precondition for each of the following sequences of assignment statements and their postconditions:
   b. `a = 3 * (2 * b + a);`
   `b = 2 * a - 1`
   `{b > 5}`

25. Compute the weakest precondition for each of the following selection constructs and their postconditions:
   a. `if (a == b)`
   `b = 2 * a + 1`
   `else`
   `b = 2 * a;`
   `{b > 1}`
   b. `if (x < y)`
   `x = x + 1`
   `else`
   `x = 3 * x`
   `{x < 0}`

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1. while: if (!Statement) goto exit;
   // do something
   goto while;

   exit: //continue rest of code

2. $M(BE, S) \Delta \Rightarrow <LE><O><RE>$
   if $M(BE.RE) == null \mid\mid M(BE.RE) == null$
      return false
   else if (BE.O).matches("{== > < >= <=}")

3. $b = (c + 10) / 3 \{b > 6\}$
   $((c + 10) / 3 > 6) / 3$
   $((c + 10) > 18) - 10$
   $\{c > 8\}$

4. Pre $\{2*a - 1 > 5\}$
   $\{a - 1 > 5/2\}$
   $\boxed{\{a > 7/2\}}$
   Post $\{3*(2*b + a) > 7/2\}$
   $\{(2*b + a) > 7/6\}$
   $\{(b + a) > 7/12\} \boxed{\{b > 7/2 - a\}}$

5. $\{x + 1 > 0\}$ $\{3*x > -13\}$
   $\{x > -1\}$ $\{x > -1/3\}$