```java
import components.naturalnumber.NaturalNumber;

/**
 * Program to evaluate XMLTree expressions of {@code int}.
 *
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 *
 */
public final class XMLTreeNNExpressionEvaluator {

    /**
     * Private constructor so this utility class cannot be
instantiated.
     */
    private XMLTreeNNExpressionEvaluator() {
    }

    /**
     * Evaluate the given expression.
     *
     * @param exp
     *            the {@code XMLTree} representing the expression
     * @return the value of the expression
     * @requires <pre>
     * [exp is a subtree of a well-formed XML arithmetic
expression]  and
     *  [the label of the root of exp is not "expression"] and
     *  [the expression will not attempt to divide by 0 and the
expression will
     *  not result in a negative number]
     *
     * </pre>
     * @ensures evaluate = [the value of the expression]
     * @ensures the value of the expression returned is >= 0
     * @ensures the expression does not divide by zero.
     */
    private static NaturalNumber evaluate(XMLTree exp) {
        assert exp != null : "Violation of: exp is not null";

        // TODO - fill in body
        NaturalNumber evaluate;
        NaturalNumber zero1 = new NaturalNumber2(0);
        String op = exp.label();
        if (exp.numberOfChildren() == 0) {
            evaluate = new
```

```
   NaturalNumber2(exp.attributeValue("value"));
51          } else {
52              XMLTree child1 = exp.child(0);
53              XMLTree child2 = exp.child(1);
54              if (op.equals("plus")) {
55                  evaluate = evaluate(child1);
56                  NaturalNumber temp2 = evaluate(child2);
57                  evaluate.add(temp2);
58              } else if (op.equals("times")) {
59                  evaluate = evaluate(child1);
60                  NaturalNumber temp2 = evaluate(child2);
61                  evaluate.multiply(temp2);
62              } else if (op.equals("divide")) {
63                  evaluate = evaluate(child1);
64                  NaturalNumber temp2 = evaluate(child2);
65                  int zero = temp2.compareTo(zero1);
66                  if (zero == 0) {
67                      Reporter.fatalErrorToConsole(
68                              "Violation: Attempting to Divide by
   Zero");
69                  }
70                  evaluate.divide(temp2);
71              } else {
72                  evaluate = evaluate(child1);
73                  NaturalNumber temp2 = evaluate(child2);
74                  int negative = temp2.compareTo(evaluate);
75                  if (negative > 0) { //the case where the difference
   is negative
76                      Reporter.fatalErrorToConsole(
77                              "Violation: Expression Evaluates to a
   Negative"
78                                      + " Number");
79                  }
80                  evaluate.subtract(temp2);
81              }
82          }
83          return evaluate;
84      }
85
86      /**
87       * Main method.
88       *
89       * @param args
90       *            the command line arguments
91       */
```

```
 92     public static void main(String[] args) {
 93         SimpleReader in = new SimpleReader1L();
 94         SimpleWriter out = new SimpleWriter1L();
 95         out.print("Enter the name of an expression XML file: ");
 96         String file = in.nextLine();
 97         while (!file.equals("")) {
 98             XMLTree exp = new XMLTree1(file);
 99             out.println(evaluate(exp.child(0)));
100             out.print("Enter the name of an expression XML file:
    ");
101             file = in.nextLine();
102         }
103
104         in.close();
105         out.close();
106     }
107
108 }
109
```