Exercise 8: Increment and Decrement Statement

In Chapter 6.6 we discussed the code generation for the increment/decrement statements (x++; and x--;), but without using the inc instruction of the μJVM. Write an attributed grammar for these statements that generates code using the inc instruction (see Section 6.1.2). To do this, write a method Code.inc(x, val) that increments a designator described by the operand x by the value val (1 or -1). Also note the context conditions (see Appendix A) as well as the fact that the inc instruction can only be used for local variables.

Solution

The attributed grammar is:

```
IncDecStatement                (. Operand x; .)
= Designator <↑x>
  (  "++"                      (. Code.inc(x, 1); .)
  |  "--"                      (. Code.inc(x, -1); .)
  )
  ";" .
```

The method inc() is implemented in the Code class and also checks the following context conditions:

- Designator must be a variable, an array element, or an object field.
- Designator must be of type int.

```
public static void inc (Operand x, int val) {
   if (x.type != Tab.intType) Parser.error("designator of type int expected");  // context condition 2
   switch (x.kind) {
      case Operand.Local:
         put(inc); put(x.adr); put(val);
         break;
      case Operand.Static:
         put(getstatic); put2(x.adr);
         if (val == 1) put(const1); else put(const_m1);
         put(add);
         put(putstatic); put2(x.adr);
         break;
      case Operand.Fld:
         put(dup);
         put(getfield); put2(x.adr);
         if (val == 1) put(const1); else put(const_m1);
         put(add);
         put(putfield); put2(x.adr);
         break;
      case Operand.Elem:
         put(dup2);
         put(aload); // must be word array (already checked)
         if (val == 1) put(const1); else put(const_m1);
         put(add);
         put(astore);
         break;
      default: Parser.error("++ or -- not applicable");  // context condition 1
   }
}
```

The inc instruction can only be used for local variables. For global variables, object fields and array elements, val must be added explicitly.