Scala Puzzlers

Excerpt

artima
ARTIMA PRESS
WALNUT CREEK, CALIFORNIA

Puzzler 2

UPSTAIRS downstairs

Scala offers several convenient ways to initialize multiple variables. Sometimes, this can lead to unexpected surprises.

What is the result of executing the following code in the REPL?

```
var MONTH = 12; var DAY = 24
var (HOUR, MINUTE, SECOND) = (12, 0, 0)
```

Possibilities

1. Prints:

   ```
   MONTH: Int = 12
   DAY: Int = 24
   HOUR: Int = 12
   MINUTE: Int = 0
   SECOND: Int = 0
   ```

2. Both statements fail to compile.

3. The first statement prints:

   ```
   MONTH: Int = 12
   DAY: Int = 24
   ```

   and the second throws a runtime exception.

4. The first statement prints:

   ```
   MONTH: Int = 12
   DAY: Int = 24
   ```

   and the second fails to compile.

Explanation

You might recall something about uppercase variables and constant values and wonder whether either line compiles. As it happens, the first line compiles fine; it's the second statement that fails to compile. The correct answer is number 4:

```
scala> var MONTH = 12; var DAY = 24
MONTH: Int = 12
DAY: Int = 24

scala> var (HOUR, MINUTE, SECOND) = (12, 0, 0)
<console>:11: error: not found: value HOUR
       var (HOUR, MINUTE, SECOND) = (12, 0, 0)
            ^


<console>:11: error: not found: value MINUTE
       var (HOUR, MINUTE, SECOND) = (12, 0, 0)
                  ^


<console>:11: error: not found: value SECOND
       var (HOUR, MINUTE, SECOND) = (12, 0, 0)
```

Scala will happily allow you to use an uppercase variable name for plain, single-value assignments of `val`s and `var`s, as in the case of `MONTH` and `DAY`. However, as the second statement demonstrates, uppercase variable names are tricky in multiple-variable assignments.

This trickiness arises because multiple-variable assignments are based on pattern matching, and within a pattern match, variables starting with an uppercase letter take on a special meaning: they are *stable identifiers*.

Stable identifiers are intended for matching against constants:

```
scala> final val TheAnswer = 42
scala> def checkGuess(guess: Int) = guess match {
         case TheAnswer => "Your guess is correct"
         case _ => "Try again"
       }
scala> checkGuess(21)
res8: String = Try again
scala> checkGuess(42)
res9: String = Your guess is correct
```

Lowercase variables, by contrast, define *variable patterns*, which cause values to be assigned:

```
scala> var (hour, minute, second) = (12, 0, 0)
hour: Int = 12
minute: Int = 0
second: Int = 0
```

In the case of our code example, you are not carrying out a variable assignment as intended, therefore, but a match against constant values.

Discussion

If you are trying to use uppercase variable names that, by extreme coincidence, happen to match values that are in scope (which could happen with common names in a large program), the pattern match will compile successfully, and either succeed or fail depending on whether the values match:

```
val HOUR = 12; val MINUTE, SECOND = 0;
scala> var (HOUR, MINUTE, SECOND) = (12, 0, 0)
val HOUR = 13; val MINUTE, SECOND = 0;
scala> var (HOUR, MINUTE, SECOND) = (12, 0, 0)
scala.MatchError: (12,0,0) (of class scala.Tuple3)
  ...
```

Note that, even in the first case where the match is successful, no variables are actually assigned: stable identifiers are never assigned a value during a

pattern match, by definition. In short, at best nothing happens, otherwise you get an exception at runtime—neither of which was intended.

Lowercase variables can also be treated as stable identifiers by enclosing them in backticks. In that case, they must be `val`s, since we are treating them as constants.

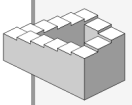
```
final val theAnswer = 42
def checkGuess(guess: Int) = guess match {
  case `theAnswer` => "Your guess is correct"
  case _ => "Try again"
}
```

```
scala> checkGuess(42)
res0: String = Your guess is correct
```

```
var theAnswer: Int = 42 // not a val, and not final either
```

```
scala> def checkGuess(guess: Int) = guess match {
         case `theAnswer` => "Your guess is correct"
         case _ => "Try again"
       }
<console>:9: error: stable identifier required, but
  theAnswer found.
         case `theAnswer` => "Your guess is correct"
```

It's unlikely to come as a surprise that uppercase names for `var`s are not considered Scala best practice: use lowercase names for `var`s (better still, avoid them completely!), and uppercase names for constants. As described in *The Scala Language Specification*, constants should also be declared `final`.[1] This prevents subclasses from overriding them, and has an additional performance benefit in that the compiler can inline them.



Use uppercase variable names only for constants.

[1] Odersky, *The Scala Language Specification*, Section 4.1. [Ode08]