MODULE *beansAlg*

EXTENDS *Integers*

CONSTANTS $M$, $N$

ASSUME $\land M \in 1 \,..\, 100$
$\land N \in 1 \,..\, 100$
$\land M + N > 0$

```
--fair algorithm beansAlg{
   variable w = M, b = N ;
  { S: while ( TRUE )
       { either
         { await (w > 1) ;   \* same color and white
               w := w - 1 ;
               } ;
           or
         { await (b > 1) ;   \* same color and black
               b := b - 2 ; w := w + 1 ;
               } ;
           or
      { await (w > 0 /\ b > 0) ;   \* different color
              w := w - 1 ;
              } ;
         }
       }
      }
```

BEGIN TRANSLATION

VARIABLES $w$, $b$

$vars \triangleq \langle w, b \rangle$

$Init \triangleq$ Global variables
$\land w = M$
$\land b = N$

$Next \triangleq \lor \land (w > 1)$
$\land w' = w - 1$
$\land b' = b$
$\lor \land (b > 1)$
$\land b' = b - 2$
$\land w' = w + 1$
$\lor \land (w > 0 \land b > 0)$
$\land w' = w - 1$
$\land b' = b$

$Spec \triangleq \land Init \land \Box[Next]_{vars}$
$\land \mathrm{WF}_{vars}(Next)$

END TRANSLATION

$$\begin{aligned} \mathit{TypeOK} &\triangleq \land\, w \in 0\,..\,100 \\ &\quad\ \land\, b \in 0\,..\,100 \\ &\quad\ \land\, w + b > 0 \\ \mathit{NonTermination} &\triangleq w + b > 1 \\ \mathit{Termination} &\triangleq \Diamond(w + b < 2) \end{aligned}$$

Consider a can of coffee beans.

Each bean is either white or black. The can is initially nonempty ($w + b > 0$). Now consider the following program:

Choose two beans from the can;

- if they are the same color, toss them out and put in a white bean

- if they are different colors, toss them out and put in a black bean

This action is repeated.