MODULE *DieHarder*

EXTENDS *Integers*

$Min(m, n) \triangleq$ IF $m < n$ THEN m ELSE n

CONSTANTS *Goal*, *Jugs*, *Capacity*

ASSUME $\land Goal \in Nat$
$\land Capacity \in [Jugs \to Nat \setminus \{0\}]$

```
**************************************************************************
--algorithm DieHarder{
    variable injug = [j ∈ Jugs ↦ 0];
    {
      while(TRUE){
       with(j ∈ Jugs){
          either{
             injug[j] := Capacity[j]
          }
          or{
             injug[j] := 0
          }
          or with(k ∈ Jugs \ {j}){
            with(poured = Min(injug[j] + injug[k], Capacity[k]) - injug[k]){
               injug[j] := injug[j] - poured ||
               injug[k] := injug[k] + poured
            }
          }

       }
     }
          while ( TRUE ) {
              either with ( j ∈ Jugs ) {    full jug j
                                 injug[j] := Capacity[j]
                           }
              or          with ( j ∈ Jugs ) {    empty jug j
                                 injug[j] := 0
                           }
              or          with ( j ∈ Jugs, k ∈ Jugs \ {j} ) {    pour from jug j to jug k
                                 with ( poured = Min(injug[j] + injug[k], Capacity[k]) - injug[k] ) {
                                       injug[j] := injug[j] - poured || injug[k] := injug[k] + poured
                           }
                    }
           }
      }
}
**************************************************************************
```

BEGIN TRANSLATION

VARIABLE $injug$

$vars \triangleq \langle injug \rangle$

$Init \triangleq$ Global variables

$\land\ injug = [j \in Jugs \mapsto 0]$

$Next \triangleq \lor \land \exists\, j \in Jugs :$
$injug' = [injug \text{ EXCEPT } ![j] = Capacity[j]]$
$\lor \land \exists\, j \in Jugs :$
$injug' = [injug \text{ EXCEPT } ![j] = 0]$
$\lor \land \exists\, j \in Jugs :$
$\exists\, k \in Jugs \setminus \{j\} :$
$\text{LET } poured \triangleq Min(injug[j] + injug[k],\ Capacity[k]) - injug[k] \text{ IN}$
$injug' = [injug \text{ EXCEPT } ![j] = injug[j] - poured,$
$![k] = injug[k] + poured]$

$Spec \triangleq Init \land \Box[Next]_{vars}$

END TRANSLATION

* Modification History
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