MODULE *DanielEuclid*

EXTENDS *Integers*, *DanielGCD*, *TLC*

CONSTANTS M, N

\ is the set difference operator

ASSUME $\land M \in Nat \setminus \{0\}$
$\land N \in Nat \setminus \{0\}$

****

```
--fair algorithm Euclid{
    variables x = M, y = N ;
   variables x ∈ 1 .. N, y ∈ 1 .. N, x0 = x, y0 = y ;   page 39 to test Euclid's algorithm for values 1 .. N
   { while ( x ≠ y ) { if ( x < y ) { y := y − x }
                       else         { x := x − y }
                     } ;
     assert (x ≠ y) ∧ (x = GCD(x0, y0))
    }
}
```

****

BEGIN TRANSLATION

VARIABLES x, y, $x0$, $y0$, pc

$vars \triangleq \langle x, y, x0, y0, pc \rangle$

$Init \triangleq$ Global variables
$\land x \in 1 \,..\, N$
$\land y \in 1 \,..\, N$
$\land x0 = x$
$\land y0 = y$
$\land pc =$ "Lbl_1"

$Lbl\_1 \triangleq \land pc =$ "Lbl_1"
$\land$ IF $x \neq y$
THEN $\land$ IF $x < y$
THEN $\land y' = y - x$
$\land x' = x$
ELSE $\land x' = x - y$
$\land y' = y$
$\land pc' =$ "Lbl_1"
ELSE $\land Assert((x \neq y) \land (x = GCD(x0, y0)),$
"Failure of assertion at line 16, column 7.")
$\land pc' =$ "Done"
$\land$ UNCHANGED $\langle x, y \rangle$
$\land$ UNCHANGED $\langle x0, y0 \rangle$

$Next \triangleq Lbl\_1$

$\lor$ Disjunct to prevent deadlock on termination
$(pc = \text{“Done”} \land \text{UNCHANGED } vars)$

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

$Termination \triangleq \Diamond(pc = \text{“Done”})$

END TRANSLATION

$PartialCorrectness \triangleq (pc = \text{“Done”}) \Rightarrow (x = y) \land (x = GCD(M, N))$

* Modification History
* Last modified *Wed Oct* 12 17:39:18 *PDT* 2016 by *Daniel*
* Created *Wed Aug* 31 17:24:26 *PDT* 2016 by *Daniel*

*
* Question 4.2 (page 34)
* Use set notation to write this assumption more compactly.
* Answer:
* ASSUME $\{M, N\} \subseteq Nat \setminus \{0\}$
*

*
* Question 4.3 (page 34)
* How many other ways can you write the set of positive integers in TLA+?
* Answer:
* ASSUME $N \in \{x \in Nat : x > 0\}$
* ASSUME $N \in \{x \in Int : x > 0\}$
* ASSUME $N \in \{x + 1 : x \in Nat\}$