MODULE *pluscal_digits*

EXTENDS *TLC*, *Integers*, *Naturals*

CONSTANTS $n0$

```
--algorithm compte{
variables n, count = 0 ;
{
  l0: n := n0 ;
  l1: while ( n ≠ 0 )
  {
     l2:  n := n ÷ 10 ;
      l3: count := count + 1 ;
   } ;
  l4:   print ⟨"Number of digits: %d", count⟩ ;
 }
 }
```

BEGIN TRANSLATION

CONSTANT *defaultInitValue*

VARIABLES n, *count*, *pc*

$vars \triangleq \langle n, count, pc \rangle$

$Init \triangleq$ Global variables
$\land\ n = defaultInitValue$
$\land\ count = 0$
$\land\ pc = \text{"l0"}$

$l0 \triangleq \land\ pc = \text{"l0"}$
$\land\ n' = n0$
$\land\ pc' = \text{"l1"}$
$\land\ count' = count$

$l1 \triangleq \land\ pc = \text{"l1"}$
$\land$ IF $n \neq 0$
THEN $\land\ pc' = \text{"l2"}$
ELSE $\land\ pc' = \text{"l4"}$
$\land$ UNCHANGED $\langle n, count \rangle$

$l2 \triangleq \land\ pc = \text{"l2"}$
$\land\ n' = (n \div 10)$
$\land\ pc' = \text{"l3"}$
$\land\ count' = count$

$l3 \triangleq \land\ pc = \text{"l3"}$
$\land\ count' = count + 1$
$\land\ pc' = \text{"l1"}$
$\land\ n' = n$

$l4 \triangleq \land\ pc = \text{“l4”}$
$\quad \land\ PrintT(\langle \text{“Number of digits: \%d”}, count \rangle)$
$\quad \land\ pc' = \text{“Done”}$
$\quad \land\ \text{UNCHANGED}\ \langle n, count \rangle$

$Next \triangleq l0 \lor l1 \lor l2 \lor l3 \lor l4$
$\quad \lor$ Disjunct to prevent deadlock on termination
$\quad (pc = \text{“Done”} \land \text{UNCHANGED}\ vars)$

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

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

END TRANSLATION

$test1 \triangleq pc = \text{“Done”} \land n0 = 345 \Rightarrow count = 3$
$test2 \triangleq pc = \text{“Done”} \land n0 = 0 \Rightarrow count = 0$
$safe \triangleq n \neq defaultInitValue \Rightarrow 0 \leq n \land n \leq n0$