

	MODULE <i>puzzle</i>	
EXTENDS <i>Integers</i>		
VARIABLES <i>puzzle</i> , <i>empty</i>		
$Init \triangleq \wedge puzzle = \langle 7, 2, 4, 5, 0, 6, 8, 3, 1 \rangle$ $\wedge empty = 5$		
$TypeOK \triangleq empty \in 1 \dots 9$ $Finished \triangleq puzzle \neq \langle 0, 1, 2, 3, 4, 5, 6, 7, 8 \rangle$		
$Left \triangleq \begin{array}{ll} \text{IF } empty \% 3 = 0 & \text{Right column} \\ \text{THEN} & \text{UNCHANGED } \langle empty, puzzle \rangle \\ \text{ELSE} & \wedge empty' = empty + 1 \\ & \wedge puzzle' = [puzzle \text{ EXCEPT } ![empty + 1] = 0, ![empty] = puzzle[empty + 1]] \end{array}$		
$Right \triangleq \begin{array}{ll} \text{IF } empty \% 3 = 1 & \text{Left column} \\ \text{THEN} & \text{UNCHANGED } \langle empty, puzzle \rangle \\ \text{ELSE} & \wedge empty' = empty - 1 \\ & \wedge puzzle' = [puzzle \text{ EXCEPT } ![empty - 1] = 0, ![empty] = puzzle[empty - 1]] \end{array}$		
$Down \triangleq \begin{array}{ll} \text{IF } empty \leq 3 & \text{Top row} \\ \text{THEN} & \text{UNCHANGED } \langle empty, puzzle \rangle \\ \text{ELSE} & \wedge empty' = empty - 3 \\ & \wedge puzzle' = [puzzle \text{ EXCEPT } ![empty - 3] = 0, ![empty] = puzzle[empty - 3]] \end{array}$		
$Up \triangleq \begin{array}{ll} \text{IF } empty \geq 7 & \text{Bottom row} \\ \text{THEN} & \text{UNCHANGED } \langle empty, puzzle \rangle \\ \text{ELSE} & \wedge empty' = empty + 3 \\ & \wedge puzzle' = [puzzle \text{ EXCEPT } ![empty + 3] = 0, ![empty] = puzzle[empty + 3]] \end{array}$		
$Next \triangleq \vee Up$ $\vee Down$ $\vee Right$ $\vee Left$		