

ADT Grid

Service : **Grid**

Type : int, bool

Observers :

getWidth : [Grid] -> int

getHeight : [Grid] -> int

isOccupied : [Grid] * int * int -> bool

précondition : *isOccupied*(G,x,y) require $x \geq 1 \ \&\& \ x \leq \text{getWidth}(G) \ \&\& \ y \geq 1 \ \&\& \ y \leq \text{getHeight}(G)$

canPut : [Grid] * int * int -> bool

Constructor :

init : int * int -> [Grid]

précondition : *init*(x,y) require $x > 0 \ \&\& \ y > 0 \ \&\& \ y \geq x$

Opérations :

put : [Grid] * int * int -> [Grid]

précondition : *put*(G,x,y) require *canPut*(G,x,y) $\ \&\& \ x \geq 1 \ \&\& \ x \leq \text{getWidth}(G) \ \&\& \ y \geq 1 \ \&\& \ y \leq \text{getHeight}(G)$

remove : [Grid] * int * int -> [Grid]

précondition : *remove*(G,x,y) require *isOccupied*(G,x,y) $\ \&\& \ x \geq 1 \ \&\& \ x \leq \text{getWidth}(G) \ \&\& \ y \geq 1 \ \&\& \ y \leq \text{getHeight}(G)$

Observations :

◦ *invariants*

$\forall x (1 \leq x \ \&\& \ x \leq \text{getWidth}(G)) \{$
 $\forall y (1 \leq y \ \&\& \ y \leq \text{getHeight}(G)) \{ \text{isOccupied}(G,x,y) = \neg \text{canPut}(G,x,y) \}$
 $\}$

◦ *init*

$\text{getWidth}(\text{init}(w,h)) = w \ \&\& \ \text{getHeight}(\text{init}(w,h)) = h$
 $\forall x \text{ in } (1 \leq x \ \&\& \ x \leq \text{getWidth}(\text{init}(w,h))) \{$
 $\forall y \text{ in } (1 \leq y \ \&\& \ y \leq \text{getHeight}(\text{init}(w,h))) \{ \neg \text{isOccupied}(\text{init}(w,h),x,y) \ \&\& \ \text{canPut}(\text{init}(w,h),x,y) \}$
 $\}$

- *put*

$$\begin{aligned}
&\neg isOccupied(put(G,x,y),x,y) = isOccupied(G,x,y) \\
&\neg canPut(put(G,x,y),x,y) \\
&\forall i \text{ in } (1 \leq i \ \&\& \ x \neq i \ \&\& \ i \leq getWidth(put(G,x,y)))\{ \\
&\forall j \text{ in } (1 \leq j \ \&\& \ j \neq y \ \&\& \ j \leq getHeight(put(G,x,y)))\{ \\
&\quad isOccupied(put(G,x,y),i,j) = isOccupied(G,i,j) \} \\
&\} \\
&\forall i \text{ in } (1 \leq i \ \&\& \ x \neq i \ \&\& \ i \leq getWidth(put(G)))\{ \\
&\forall j \text{ in } (1 \leq j \ \&\& \ j \neq y \ \&\& \ j \leq getHeight(put(G)))\{ canPut(put(G),i,j) \} \\
&\}
\end{aligned}$$
- *remove*

$$\begin{aligned}
&isOccupied(remove(G,x,y),x,y) = \neg isOccupied(G,x,y) \\
&canPut(remove(G,x,y),x,y) \\
&\forall i \text{ in } (1 \leq i \ \&\& \ x \neq i \ \&\& \ i \leq getWidth(remove(G,x,y)))\{ \\
&\forall j \text{ in } (1 \leq j \ \&\& \ j \neq y \ \&\& \ j \leq getHeight(remove(G,x,y)))\{ \\
&\quad isOccupied(remove(G,x,y),i,j) = \neg isOccupied(G,i,j) \} \\
&\} \\
&\forall i \text{ in } (1 \leq i \ \&\& \ x \neq i \ \&\& \ i \leq getWidth(remove(G,x,y)))\{ \\
&\forall j \text{ in } (1 \leq j \ \&\& \ j \neq y \ \&\& \ j \leq getHeight(remove(G,x,y)))\{ canPut(remove(G,x,y),i,j) \} \\
&\}
\end{aligned}$$