MODULE *optishopylist*

```
EXTENDS TLC, Integers, FiniteSets, Sequences
CONSTANTS ITEM_IDs, SHOPYLISTS

PT ≜ INSTANCE PT

ShopyItems ≜ [id : ITEM_IDs, bought : BOOLEAN ]

Actions ≜ {"add", "rm", "set_bought"}

set ++ item ≜ set ∪ {item}
set −− item ≜ set ∪ {item}
```

The spec now depicts a shopping-list app where the server app manages several users and hence multiple lists of items that synch eventually.

The list contains unique items, thus we use a set.

```
   --algorithm OptiShopyList

define
    NewShopyItem(shopyList) ≜
        [id     ↦ (CHOOSE x ∈ ITEM_IDs : ¬∃ i ∈ shopyList : x = i.id),
         bought ↦ FALSE]
    ExistingShopyItem(shopyList) ≜ CHOOSE x ∈ shopyList : TRUE
    ExistingNotBoughtShopyItem(shopyList) ≜ CHOOSE x ∈ shopyList : x.bought = FALSE
end define ;

process shopylist ∈ SHOPYLISTS
variables
      a sequence of actions sent by the clients
    actionQueue = ⟨⟩,
    processedAction = "",
      one shopping list
    shopyList = {} ;

begin AppLoop:
    while TRUE do

        either
              the user chooses an action
            with action ∈ Actions do
                actionQueue := Append(actionQueue, action) ;
            end with ;
        or
            await actionQueue ≠ ⟨⟩ ;
            processedAction := Head(actionQueue) ;
            actionQueue := Tail(actionQueue) ;
            ProcessAction:
            either
            ADD:
                await processedAction = "add" ;
                await Cardinality(shopyList) < Cardinality(ITEM_IDs) ;
                Adding an existing item is not an error, it just does nothing new to the list.
                shopyList := shopyList ++ NewShopyItem(shopyList) ;
            or
            REMOVE:
                await processedAction = "rm" ;
                await shopyList ≠ {} ;
                shopyList := shopyList −− ExistingShopyItem(shopyList) ;
            or
            SET_BOUGHT:
                await processedAction = "set_bought" ;
                await shopyList ≠ {} ;
                This action really is not detailed in this spec, an integer stays an integer.
                with modifiedItem = ExistingNotBoughtShopyItem(shopyList) do
                    shopyList := shopyList −− modifiedItem ++ [modifiedItem EXCEPT !.bought = TRUE] ;
                end with ;
            end either ;
        end either ;
    end while ;
end process ;

end algorithm ;
 BEGIN TRANSLATION (chksum(pcal) = "d99bc2da" ∧ chksum(tla) = "88cb80ca")
VARIABLE pc

 define statement
NewShopyItem(shopyList) ≜
    [id     ↦ (CHOOSE x ∈ ITEM_IDs : ¬∃ i ∈ shopyList : x = i.id),
     bought ↦ FALSE]
ExistingShopyItem(shopyList) ≜ CHOOSE x ∈ shopyList : TRUE
ExistingNotBoughtShopyItem(shopyList) ≜ CHOOSE x ∈ shopyList : x.bought = FALSE

VARIABLES actionQueue, processedAction, shopyList

vars ≜ ⟨pc, actionQueue, processedAction, shopyList⟩

ProcSet ≜ (SHOPYLISTS)

Init ≜  Process shopylist
         ∧ actionQueue = [self ∈ SHOPYLISTS ↦ ⟨⟩]
         ∧ processedAction = [self ∈ SHOPYLISTS ↦ ""]
         ∧ shopyList = [self ∈ SHOPYLISTS ↦ {}]
        $\land\ pc = [\mathit{self} \in \mathit{ProcSet} \mapsto \text{“}\textsf{AppLoop}\text{”}]$

$\mathit{AppLoop}(\mathit{self}) \triangleq\ \land\ pc[\mathit{self}] = \text{“}\textsf{AppLoop}\text{”}$
                     $\land\ \lor\ \land\ \exists\, \mathit{action} \in \mathit{Actions} :$
                                 $\mathit{actionQueue}' = [\mathit{actionQueue}\ \textsc{except}\ ![\mathit{self}] = \mathit{Append}(\mathit{actionQueue}[\mathit{self}],\ \mathit{actio}$
                           $\land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{AppLoop}\text{”}]$
                           $\land\ \textsc{unchanged}\ \mathit{processedAction}$
                        $\lor\ \land\ \mathit{actionQueue}[\mathit{self}] \neq \langle\rangle$
                           $\land\ \mathit{processedAction}' = [\mathit{processedAction}\ \textsc{except}\ ![\mathit{self}] = \mathit{Head}(\mathit{actionQueue}[\mathit{self}])]$
                           $\land\ \mathit{actionQueue}' = [\mathit{actionQueue}\ \textsc{except}\ ![\mathit{self}] = \mathit{Tail}(\mathit{actionQueue}[\mathit{self}])]$
                           $\land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{ProcessAction}\text{”}]$
                     $\land\ \textsc{unchanged}\ \mathit{shopyList}$

$\mathit{ProcessAction}(\mathit{self}) \triangleq\ \land\ pc[\mathit{self}] = \text{“}\textsf{ProcessAction}\text{”}$
                           $\land\ \lor\ \land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{ADD}\text{”}]$
                              $\lor\ \land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{REMOVE}\text{”}]$
                              $\lor\ \land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{SET\_BOUGHT}\text{”}]$
                           $\land\ \textsc{unchanged}\ \langle \mathit{actionQueue},\ \mathit{processedAction},\ \mathit{shopyList} \rangle$

$\mathit{ADD}(\mathit{self}) \triangleq\ \land\ pc[\mathit{self}] = \text{“}\textsf{ADD}\text{”}$
                 $\land\ \mathit{processedAction}[\mathit{self}] = \text{“}\textsf{add}\text{”}$
                 $\land\ \mathit{Cardinality}(\mathit{shopyList}[\mathit{self}]) < \mathit{Cardinality}(\mathit{ITEM\_IDs})$
                 $\land\ \mathit{shopyList}' = [\mathit{shopyList}\ \textsc{except}\ ![\mathit{self}] = \mathit{shopyList}[\mathit{self}] \mathbin{++} \mathit{NewShopyItem}(\mathit{shopyList}[\mathit{self}]$
                 $\land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{AppLoop}\text{”}]$
                 $\land\ \textsc{unchanged}\ \langle \mathit{actionQueue},\ \mathit{processedAction} \rangle$

$\mathit{REMOVE}(\mathit{self}) \triangleq\ \land\ pc[\mathit{self}] = \text{“}\textsf{REMOVE}\text{”}$
                     $\land\ \mathit{processedAction}[\mathit{self}] = \text{“}\textsf{rm}\text{”}$
                     $\land\ \mathit{shopyList}[\mathit{self}] \neq \{\}$
                     $\land\ \mathit{shopyList}' = [\mathit{shopyList}\ \textsc{except}\ ![\mathit{self}] = \mathit{shopyList}[\mathit{self}] \mathbin{--} \mathit{ExistingShopyItem}(\mathit{shopy}$
                     $\land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{AppLoop}\text{”}]$
                     $\land\ \textsc{unchanged}\ \langle \mathit{actionQueue},\ \mathit{processedAction} \rangle$

$\mathit{SET\_BOUGHT}(\mathit{self}) \triangleq\ \land\ pc[\mathit{self}] = \text{“}\textsf{SET\_BOUGHT}\text{”}$
                          $\land\ \mathit{processedAction}[\mathit{self}] = \text{“}\textsf{set\_bought}\text{”}$
                          $\land\ \mathit{shopyList}[\mathit{self}] \neq \{\}$
                          $\land\ \textsc{let}\ \mathit{modifiedItem} \triangleq \mathit{ExistingNotBoughtShopyItem}(\mathit{shopyList}[\mathit{self}])\textsc{in}$
                                $\mathit{shopyList}' = [\mathit{shopyList}\ \textsc{except}\ ![\mathit{self}] = \mathit{shopyList}[\mathit{self}] \mathbin{--} \mathit{modifiedItem} \mathbin{++}$
                          $\land\ pc' = [pc\ \textsc{except}\ ![\mathit{self}] = \text{“}\textsf{AppLoop}\text{”}]$
                          $\land\ \textsc{unchanged}\ \langle \mathit{actionQueue},\ \mathit{processedAction} \rangle$

$\mathit{shopylist}(\mathit{self}) \triangleq\ \mathit{AppLoop}(\mathit{self}) \lor \mathit{ProcessAction}(\mathit{self}) \lor \mathit{ADD}(\mathit{self})$
                        $\lor\ \mathit{REMOVE}(\mathit{self}) \lor \mathit{SET\_BOUGHT}(\mathit{self})$

$\mathit{Next} \triangleq (\exists\, \mathit{self} \in \mathit{SHOPYLISTS} : \mathit{shopylist}(\mathit{self}))$

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

END TRANSLATION

$$
\begin{array}{l}
\mathit{TypeOK} \triangleq \\
\quad \land \quad PT!\mathit{Range}(\mathit{actionQueue}) \in \textsc{subset}\ \mathit{Actions} \\
\quad \land \quad \mathit{shopyList} \in \textsc{subset}\ \mathit{ShopyItems}
\end{array}
$$

* Modification History
* Last modified *Thu Mar* 04 12:03:35 *CET* 2021 by *davd*
* Created *Tue Mar* 02 12:33:43 *CET* 2021 by *davd*