

**section** *Supermarket parents standard\_toolkit*

A supermarket has a loyalty card scheme. It records the purchases of each customer and rewards them with points (worth apenny). There are two grades of card: silver and gold. One point is awarded to a silver card holder, and two to a gold card holder, for each pound spent. From time to time the supermarket sends out vouchers for the number of points outstanding, in units of 1, rounding down; any spare points count towards the next voucher. On joining the scheme each customer is given 100 points.

[*CUSTOMER*]

*CARD* ::= *None* | *Silver* | *Gold*

*LoyaltyScheme*

---

*Customer* :  $\mathbb{F}$  *CUSTOMER*  
*Points* : *CUSTOMER*  $\leftrightarrow$   $\mathbb{N}$   
*Cards* : *CUSTOMER*  $\leftrightarrow$  *CARD*

---

*Points*  $\in$  *CUSTOMER*  $\leftrightarrow$   $\mathbb{N}$   
*Cards*  $\in$  *CUSTOMER*  $\leftrightarrow$  *CARD*

---

*Join*

---

$\Delta$ *LoyaltyScheme*  
*cust?* : *CUSTOMER*

---

*cust?*  $\in$  *Customer*  
*Cards*(*cust?*) = *None*  
*Customer'* = *Customer*  $\cap$  {*cust?*}  
*Points'* = *Points*  $\cap$  {*cust?*  $\mapsto$  100}  
*Cards'* = *Cards*  $\cap$  {*cust?*  $\mapsto$  *Silver*}

---

*Upgrade*

$\Delta$ *LoyaltyScheme*  
*ans!* : *CARD*  
*cust?* : *CUSTOMER*

*cust?*  $\in$  *Customer*  
*cust?*  $\mapsto$  *Silver*  $\in$  *Cards*  
*Customer'* = *Customer*  
*Points'* = *Points*  
*Cards'* = *Cards*  $\oplus$  { *cust?*  $\mapsto$  *Gold* }

*TillReceipt*

$\Delta$ *LoyaltyScheme*  
*cust?* : *CUSTOMER*  
*receipt?* :  $\mathbb{N}$

*Cards cust?*  $\in$  { *Silver*, *Gold* }  
*cust?*  $\in$  *Customer*  
*Customer'* = *Customer*  
*Points'* = *Points*  $\oplus$  { *cust?*  $\mapsto$  *Points cust?* +  
    **if** *Cards cust?* = *Gold* **then** *receipt?* mod 100 **else** 2 \* *receipt?* mod 100 }  
*Cards'* = *Cards*

*Issue*

$\Delta$ *LoyaltyScheme*  
*cust?* : *CUSTOMER*  
*numvouchers!* :  $\mathbb{N}$

*Customer'* = *Customer*  
*Points'* = *Points*  $\oplus$  { *cust?*  $\mapsto$  *Points cust?* mod 100 }  
*Cards'* = *Cards*  
*numvouchers!* = *Points cust?* div 100