class $GetraenkeAutomat$

types

$Money = \mathbb{N}$

functions

$sum : \mathbb{N}_1\text{-set} \rightarrow \mathbb{N}$

$sum\,(s) \triangleq$
 if $s = \{\}$
 then 0
 else let $m \in s$ in
  $m + sum\,(s \setminus \{m\})$

types

$Coin = \text{ONE} \mid \text{TWO} \mid \text{FIVE} \mid \text{TEN} \mid \text{TWENTY} \mid \text{FIFTY};$

$CoinValues = Coin \xrightarrow{m} Money$
 inv $cv \triangleq \forall\, c : Coin \cdot c \in \text{dom}\ cv$

values

$WORTH : CoinValues = \{$
 $\text{ONE} \mapsto 1, \text{TWO} \mapsto 2,$
 $\text{FIVE} \mapsto 5, \text{TEN} \mapsto 10,$
 $\text{TWENTY} \mapsto 20, \text{FIFTY} \mapsto 50\}$

types

$Cash = Coin \xrightarrow{m} \mathbb{N}$

functions

$valueOf : Cash \rightarrow Money$

$valueOf\,(ca) \triangleq$
 $sum\,(\{WORTH\,(co) \times ca\,(co) \mid co \in \text{dom}\ ca\});$

$numOfCoinsInCash : Cash \times Coin \rightarrow \mathbb{N}$

$numOfCoinsInCash\,(ca, co) \triangleq$
 if $co \in \text{dom}\ ca$
 then $ca\,(co)$
 else 0;

$possibleChanges : Cash \rightarrow Cash\text{-set}$

$possibleChanges\,(ch) \triangleq$
 $\{c \mid c : Cash \cdot (\text{dom}\ c \subseteq \text{dom}\ ch) \wedge$
  $(\forall\, c\text{-}elem \in \text{dom}\ c \cdot$
   $c\,(c\text{-}elem) \leq ch\,(c\text{-}elem))\};$

$coinCombinations : Money \rightarrow Cash\text{-set}$

$coinCombinations\,(m) \triangleq$
 $\{c \mid c : Cash \cdot valueOf\,(c) = m\}$

types

$Drink = Tea\text{-}or\text{-}coffee \mid \text{CHOCOLATE};$

$Tea\text{-}or\text{-}coffee :: flavor : \text{TEA} \mid \text{COFFEE}$
 $white : \mathbb{B}$
 $sweet : \mathbb{B};$

$Ingredient = \text{TEA} \mid \text{COFFEE} \mid \text{CHOCOLATE} \mid \text{MILK} \mid \text{SUGAR} \mid \text{WATER};$

$Prices = Drink \xrightarrow{m} Money;$

$Stock = Ingredient \xrightarrow{m} \mathbb{N}$

$\quad$ inv $s \triangleq \forall\, i : Ingredient \cdot i \in$ dom s

values

$INGREDIENTS : Drink \xrightarrow{m} Ingredient\text{-set} = \{\text{CHOCOLATE} \mapsto \{\text{CHOCOLATE}, \text{WATER}\}\} \overset{m}{\cup}$

$\{d \mapsto$
$\{d.flavor, \text{WATER}\} \cup$
$(\text{if } d.white$
$\text{then } \{\text{MILK}\}$
$\text{else } \{\}) \cup$
$(\text{if } d.sweet$
$\text{then } \{\text{SUGAR}\}$
$\text{else } \{\}) \mid$
$d : Tea\text{-}or\text{-}coffee\}$

instance variables

$balance : Money := 0;$
$stock : Stock := \{i \mapsto 0 \mid i : Ingredient\};$
$cups : \mathbb{N} := 0;$
$takings : Cash := \{c \mapsto 0 \mid c : Coin\};$
$prices : Prices := \{d \mapsto 0 \mid d : Drink\};$

operations

$do\text{-}service : Stock \times \mathbb{N} \times Cash \times Prices \xrightarrow{o} ()$

$do\text{-}service\,(newStock, newCups, newTakings, newPrices) \triangleq$

is not yet specified

pre $balance = 0$

post

$stock = newStock \wedge$
$cups = newCups \wedge$
$takings = newTakings \wedge$
$prices = newPrices$

values

$c1 :$ char$^* =$ "$Eine\ \ Muenze\ \ einwerfen$"

operations

$insertCoin : Coin \xrightarrow{o} ()$

$insertCoin\,(c) \triangleq$

is not yet specified

pre true

post

$(balance = \overleftarrow{balance} + WORTH\,(c)) \wedge$
$(takings = \overleftarrow{takings} \dagger \{c \mapsto \overleftarrow{takings}\,(c) + 1\})$

values

$c2 :$ char$^* =$ "$Getraenke\text{-}Auswahlknopf\ \ betaetigen$"

operations

$getDrink : Drink \xrightarrow{o} Drink$

$getDrink\,(d) \triangleq$

is not yet specified

pre $(balance \geq prices\,(d)) \wedge$
$(cups > 0) \wedge$
$(\forall\, i \in INGREDIENTS\,(d) \cdot stock\,(i) > 0)$

post
$(balance = \overleftarrow{balance} - prices\,(d)) \wedge$
$(cups = \overleftarrow{cups} - 1) \wedge$
$(stock = \overleftarrow{stock} \dagger \{i \mapsto \overleftarrow{stock}\,(i) - 1 \mid i \in INGREDIENTS\,(d)\}) \wedge$

$(RESULT = d)$

values

$c3$: char* = "*Restgeld-Auswurfknopf betaetigen*"

operations

$getChange : () \xrightarrow{o} Cash$

$getChange\,() \triangleq$

is not yet specified

pre $coinCombinations\,(balance) \cap possibleChanges\,(takings) \neq \{\}$

post
$(RESULT \in coinCombinations\,(balance) \cap possibleChanges\,(takings)) \wedge$
$(balance = 0) \wedge$
$(\forall\, c \in \mathrm{dom}\ RESULT \cdot RESULT\,(c) + takings\,(c) = \overleftarrow{takings}\,(c))$

end $GetraenkeAutomat$