Contents

CONTEXT CL_C0
CONSTANTS
N_DESK
AXIOMS
axm1: $N\_DESK \in \mathbb{N}_1$
END

MACHINE CL_M0
SEES CL_C0
VARIABLES

line_sensor

can_enter

cashier_busy

cashier_sensor

INVARIANTS

inv1: $line\_sensor \in BOOL$
A person has walked past the entrance line

inv2: $can\_enter \in BOOL$
Signal that a cashier is free

inv3: $cashier\_busy \in 1 \mathinner{..} N\_DESK \to BOOL$
Whether a cashier is or not busy

inv4: $cashier\_sensor \in 1 \mathinner{..} N\_DESK \to BOOL$
Whether a person is entering a cashier

inv5:
$line\_sensor = TRUE \Rightarrow$
$(\exists x \cdot (x \in 1 \mathinner{..} N\_DESK \land cashier\_busy(x) = FALSE))$
If a person goes to the desk, there is a free cashier

inv6: $can\_enter = TRUE \Rightarrow (\exists x \cdot (x \in 1 \mathinner{..} N\_DESK \land cashier\_busy(x) = FALSE))$

inv7: $\exists x \cdot ((x \in 1 \mathinner{..} N\_DESK \land cashier\_sensor(x) = TRUE \land cashier\_busy(x) = FALSE) \Rightarrow can\_enter = FALSE)$
Aux.

inv8: $\exists x \cdot ((x \in 1 \mathinner{..} N\_DESK \land cashier\_sensor(x) = TRUE \land cashier\_busy(x) = FALSE) \Rightarrow line\_sensor = FALSE)$
Aux

EVENTS
Initialisation
begin

act1: $line\_sensor := FALSE$
act2: $can\_enter := FALSE$
act3: $cashier\_busy := 1 \mathinner{..} N\_DESK \times \{FALSE\}$
act6: $cashier\_sensor := 1 \mathinner{..} N\_DESK \times \{FALSE\}$

end

Event in_wait ⟨ordinary⟩ $\widehat{=}$
Person: waiting for desk
when

grd1: $can\_enter = TRUE$
Sign that we can enter
grd2: $line\_sensor = FALSE$
No one else in the corridor

then

act3: $line\_sensor := TRUE$
A person cannot make cam_enter false here...

end

Event in_payment ⟨ordinary⟩ $\widehat{=}$
Person: enter cashier
any

k

where

grd1: $line\_sensor = TRUE$
grd2: $k \in 1 \mathinner{..} N\_DESK$
grd3: $cashier\_sensor(k) = FALSE$
grd4: $cashier\_busy(k) = FALSE$

then

act1: $cashier\_sensor(k) := TRUE$
act3: $can\_enter := FALSE$
end

Event leave ⟨ordinary⟩ $\widehat{=}$
any
k
where
grd1: $k \in 1 \mathinner{..} N\_DESK$
Person: leave cashier after payment
grd2: $cashier\_sensor(k) = TRUE$
grd3: $cashier\_busy(k) = TRUE$
then
act1: $cashier\_sensor(k) := FALSE$
end

Event to_pay ⟨ordinary⟩ $\widehat{=}$
System: enter cashier to pay, mark it is busy, free line
any
k
where
grd1: $k \in 1 \mathinner{..} N\_DESK$
grd2: $cashier\_busy(k) = FALSE$
grd3: $cashier\_sensor(k) = TRUE$
then
act1: $cashier\_busy(k) := TRUE$
act3: $line\_sensor := FALSE$
There is no one in sight, so we need to stop people from entering
act4: $can\_enter := FALSE$
Person paying, we need to allow new clients aware that more can enter
end

Event to_leave ⟨ordinary⟩ $\widehat{=}$
System: finished paying, mark cashier is free again
any
k
where
grd1: $k \in 1 \mathinner{..} N\_DESK$
grd2: $cashier\_busy(k) = TRUE$
grd3: $cashier\_sensor(k) = FALSE$
then
act1: $cashier\_busy(k) := FALSE$
end

Event new client ⟨ordinary⟩ $\widehat{=}$
System: if no one in line and there are free cashiers, check if anyone can enter
when
grd1: $line\_sensor = FALSE$
grd2: $can\_enter = FALSE$
grd3: $\exists x \cdot (x \in 1 \mathinner{..} N\_DESK \land cashier\_busy(x) = FALSE \land cashier\_sensor(x) = FALSE)$
then
act1: $can\_enter := TRUE$
end

END

MACHINE CL_M1

Here we add a variable for the display to state what cashier we can go to

REFINES CL_M0

SEES CL_C0

VARIABLES

line_sensor

can_enter

cashier_busy

cashier_sensor

cashier_number

INVARIANTS

inv1: $cashier\_number \in 0 \,..\, N\_DESK$

inv2: $cashier\_number = 0 \Leftrightarrow can\_enter = FALSE$

EVENTS

Initialisation ⟨extended⟩

begin

act1: $line\_sensor := FALSE$

act2: $can\_enter := FALSE$

act3: $cashier\_busy := 1 \,..\, N\_DESK \times \{FALSE\}$

act6: $cashier\_sensor := 1 \,..\, N\_DESK \times \{FALSE\}$

act7: $cashier\_number := 0$

end

Event in_wait ⟨ordinary⟩ $\widehat{=}$

Person: waiting for desk

extends in_wait

when

grd1: $can\_enter = TRUE$

Sign that we can enter

grd2: $line\_sensor = FALSE$

No one else in the corridor

grd3: $cashier\_number \neq 0$

then

act3: $line\_sensor := TRUE$

A person cannot make cam_enter false here...

end

Event in_payment ⟨ordinary⟩ $\widehat{=}$

Person: enter cashier

extends in_payment

any

k

where

grd1: $line\_sensor = TRUE$

grd2: $k \in 1 \,..\, N\_DESK$

grd3: $cashier\_sensor(k) = FALSE$

grd4: $cashier\_busy(k) = FALSE$

then

act1: $cashier\_sensor(k) := TRUE$

act3: $can\_enter := FALSE$

act4: $cashier\_number := 0$

end

Event leave ⟨ordinary⟩ $\widehat{=}$

extends leave

any

k

where

grd1: $k \in 1 \mathinner{..} N\_DESK$
Person: leave cashier after payment
grd2: $cashier\_sensor(k) = TRUE$
grd3: $cashier\_busy(k) = TRUE$

then

act1: $cashier\_sensor(k) := FALSE$

end

Event to_pay ⟨ordinary⟩ $\widehat{=}$

System: enter cashier to pay, mark it is busy, free line

extends to_pay

any

k

where

grd1: $k \in 1 \mathinner{..} N\_DESK$
grd2: $cashier\_busy(k) = FALSE$
grd3: $cashier\_sensor(k) = TRUE$

then

act1: $cashier\_busy(k) := TRUE$
act3: $line\_sensor := FALSE$
There is no one in sight, so we need to stop people from entering
act4: $can\_enter := FALSE$
Person paying, we need to allow new clients aware that more can enter
act5: $cashier\_number := 0$

end

Event to_leave ⟨ordinary⟩ $\widehat{=}$

System: finished paying, mark cashier is free again

extends to_leave

any

k

where

grd1: $k \in 1 \mathinner{..} N\_DESK$
grd2: $cashier\_busy(k) = TRUE$
grd3: $cashier\_sensor(k) = FALSE$

then

act1: $cashier\_busy(k) := FALSE$

end

Event new client ⟨ordinary⟩ $\widehat{=}$

System: if no one in line and there are free cashiers, check if anyone can enter

extends new client

when

grd1: $line\_sensor = FALSE$
grd2: $can\_enter = FALSE$
grd3: $\exists x \cdot (x \in 1 \mathinner{..} N\_DESK \land cashier\_busy(x) = FALSE \land cashier\_sensor(x) = FALSE)$
grd4: $cashier\_number = 0$

then

act1: $can\_enter := TRUE$
act2: $cashier\_number :\in \{x | x \in 1 \mathinner{..} N\_DESK \land cashier\_busy(x) = FALSE \land cashier\_sensor(x) = FALSE\}$

end

END