MACHINE m3
REFINES m2
SEES c0
VARIABLES

wait
process
cs
clk
t1
t2
qsize
queue
twish
tenter
tleave

INVARIANTS

inv1: $twish \in \mathbb{N}$
inv2: $tenter \in 1 \mathinner{..} csnum \pfun \mathbb{N}$
inv3: $tleave \in 1 \mathinner{..} csnum \pfun \mathbb{N}$
inv4: $\forall i \cdot i \in ran(cs) \Rightarrow i \in dom(tenter)$
inv5: $\forall i \cdot i \in ran(cs) \Rightarrow i \in dom(tleave)$

EVENTS

Initialisation ⟨extended⟩

begin

act1: $wait := \varnothing$
act2: $process := \varnothing$
act3: $cs := \varnothing$
act4: $clk := 0$
act5: $t1 := \varnothing$
act6: $t2 := \varnothing$
act7: $qsize := 0$
act8: $queue := \varnothing$
act9: $twish := 0$
act10: $tenter := 1 \mathinner{..} csnum \times \{0\}$
act11: $tleave := 1 \mathinner{..} csnum \times \{0\}$

end

Event wish_empty ⟨ordinary⟩ $\widehat{=}$
extends wish

any

pro

where

grd1: $pro \in PROCESS \setminus wait$
grd2: $pro \in PROCESS \setminus process$
grd3: $wait = \varnothing \land process = \varnothing$

then

act1: $wait := wait \cup \{pro\}$
act2: $t1(pro) := clk$
act3: $queue(qsize + 1) := pro$
act4: $qsize := qsize + 1$
act5: $twish := clk$

end

Event wish_nonempty ⟨ordinary⟩ $\widehat{=}$
extends wish

any

pro

where
grd1: $pro \in PROCESS \setminus wait$
grd2: $pro \in PROCESS \setminus process$
grd3: $wait \neq \varnothing \lor process \neq \varnothing$
then
act1: $wait := wait \cup \{pro\}$
act2: $t1(pro) := clk$
act3: $queue(qsize + 1) := pro$
act4: $qsize := qsize + 1$
end

Event enter ⟨ordinary⟩ $\widehat{=}$
extends enter
any
pro
i
where
grd1: $pro \in wait$
grd2: $i \in 1 \mathinner{..} csnum$
grd3: $i \notin ran(cs)$
grd4: $qsize > 0$
grd5: $pro = queue(1)$
then
act1: $wait := wait \setminus \{pro\}$
act2: $process := process \cup \{pro\}$
act3: $cs(pro) := i$
act4: $t2(pro) := clk$
act5: $queue :\mid queue' \in 1 \mathinner{..} qsize - 1 \rightarrowtail wait \setminus \{queue(1)\} \land (\forall j \cdot j \in 1 \mathinner{..} qsize - 1 \Rightarrow queue'(j) = queue(j + 1))$
act6: $qsize := qsize - 1$
act7: $tenter(i) := clk$
end

Event leave ⟨ordinary⟩ $\widehat{=}$
extends leave
any
pro
where
grd1: $pro \in process$
grd2: $queue \neq \varnothing$
then
act1: $process := process \setminus \{pro\}$
act2: $cs := \{pro\} \lhd cs$
act3: $tleave(cs(pro)) := clk$
end

Event leave_idle ⟨ordinary⟩ $\widehat{=}$
extends leave
any
pro
where
grd1: $pro \in process$
grd2: $queue = \varnothing$
then
act1: $process := process \setminus \{pro\}$
act2: $cs := \{pro\} \lhd cs$
act3: $tleave(cs(pro)) := clk$
end

Event tick ⟨ordinary⟩ $\widehat{=}$
refines tick
when

grd1: $\forall p \cdot (p \in wait \land p \in dom(t1)) \Rightarrow clk + 1 - t1(p) \leq ddl1$
grd2: $\forall i \cdot (i \in 1 \mathinner{..} csnum \land i \notin ran(cs) \land wait \neq \varnothing \land twish \geq tleave(i)) \Rightarrow clk + 1 - twish \leq ddl4$
grd3: $\forall i \cdot (i \in 1 \mathinner{..} csnum \land i \notin ran(cs) \land wait \neq \varnothing \land tleave(i) \geq twish) \Rightarrow clk + 1 - tleave(i) \leq ddl4$
grd4: $\forall i \cdot i \in ran(cs) \Rightarrow clk + 1 - tenter(i) \leq ddl2$

then

act1: $clk := clk + 1$

end

END