MACHINE m3
REFINES m2
SEES c0
VARIABLES

    wait

    process

    clk

    t1

    t2

    qsize

    queue

    dqueue

    t3

    index

INVARIANTS

    inv1: $dqueue \in PROCESS \nrightarrow \mathbb{N}$

    inv3: $\forall p \cdot p \in dom(dqueue) \Rightarrow 0 \leq dqueue(p) \wedge dqueue(p) \leq clk$

    inv4: $\forall p \cdot (p \in wait \wedge p \in dom(dqueue) \wedge p = queue(1) \wedge process = \varnothing) \Rightarrow clk - dqueue(p) \leq ddl4$

    inv5: $\forall p \cdot (p \in dom(dqueue) \wedge p \in dom(t2) \wedge t2(p) \geq dqueue(p)) \Rightarrow t2(p) - dqueue(p) \leq ddl4$
        deadline(wish_empty/leave,enter,ddl4)

    inv6: $t3 \in PROCESS \nrightarrow \mathbb{N}$

    inv7: $\forall p \cdot (p \in process \wedge p \in dom(t2)) \Rightarrow clk - t2(p) \leq ddl2$

    inv8: $\forall p \cdot p \in dom(t3) \Rightarrow 0 \leq t3(p) \wedge t3(p) \leq clk$

    inv9: $\forall p \cdot (p \in dom(t2) \wedge p \in dom(t3) \wedge t3(p) \geq t2(p)) \Rightarrow t3(p) - t2(p) \leq ddl2$
        deadline(enter,leave,ddl2)

    inv11: $index \in PROCESS \nrightarrow \mathbb{N}$

    inv10: $\forall p \cdot (p \in dom(t2) \wedge p \in dom(t3) \wedge t3(p) \geq t2(p) \wedge t3(p) = dqueue(queue(1)) \wedge queue \neq \varnothing) \Rightarrow dqueue(queue(1)) - t2(p) \leq ddl2$
        deadline(enter,leave,ddl2)

EVENTS
Initialisation ⟨extended⟩

    begin

        act1: $wait := \varnothing$

        act2: $process := \varnothing$

        act3: $clk := 0$

        act4: $t1 := \varnothing$

        act5: $t2 := \varnothing$

        act7: $qsize := 0$

        act8: $queue := \varnothing$

        act9: $dqueue := \varnothing$

        act10: $t3 := \varnothing$

        act11: $index := \varnothing$

    end

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

    any

        pro

    where

        grd1: $pro \in PROCESS \setminus wait$

        grd2: $pro \in PROCESS \setminus process$

        grd3: $wait = \varnothing \wedge process = \varnothing$

    then

        act1: $wait := wait \cup \{pro\}$

        act2: $t1(pro) := clk$

        act3: $queue(qsize + 1) := pro$

    act4: $qsize := qsize + 1$
    act5: $dqueue(pro) := clk$
    act6: $index(pro) := qsize$
  end
Event wish_nonempty ⟨ordinary⟩ $\widehat{=}$
extends wish
  any
    pro
  where
    grd1: $pro \in PROCESS \setminus wait$
    grd2: $pro \in PROCESS \setminus process$
    grd3: $wait \neq \varnothing \vee process \neq \varnothing$
  then
    act1: $wait := wait \cup \{pro\}$
    act2: $t1(pro) := clk$
    act3: $queue(qsize + 1) := pro$
    act4: $qsize := qsize + 1$
    act6: $index(pro) := qsize$
  end
Event enter ⟨ordinary⟩ $\widehat{=}$
extends enter
  any
    pro
  where
    grd1: $pro \in wait$
    grd2: $card(process) = 0$
    grd3: $qsize > 0$
    grd4: $pro = queue(1)$
  then
    act1: $wait := wait \setminus \{pro\}$
    act2: $process := process \cup \{pro\}$
    act3: $t2(pro) := clk$
    act4: $queue :\mid queue' \in 1 .. qsize - 1 \twoheadrightarrow wait \setminus \{queue(1)\} \wedge (\forall i \cdot i \in 1 .. qsize - 1 \Rightarrow queue'(i) = queue(i + 1))$
    act5: $qsize := qsize - 1$
  end
Event leave ⟨ordinary⟩ $\widehat{=}$
extends leave
  any
    pro
  where
    grd1: $pro \in process$
    grd2: $queue \neq \varnothing$
  then
    act1: $process := process \setminus \{pro\}$
    act3: $dqueue(queue(1)) := clk$
    act4: $t3(pro) := clk$
  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: $t3(pro) := clk$

   end
Event tick ⟨ordinary⟩ $\widehat{=}$
refines tick
  when
    grd2: $\forall p \cdot (p \in process \land p \in dom(t2)) \Rightarrow clk + 1 - t2(p) \le ddl2$
    grd3: $\forall p \cdot (p \in wait \land p \in dom(dqueue) \land p = queue(1) \land process = \varnothing) \Rightarrow clk + 1 - dqueue(p) \le ddl4$
  then
    act1: $clk := clk + 1$
  end
END