Car: is Cliente

Loop

    direction:= random (NORTH, SOUTH)

    monitor. wants - enter(direction)

    monitor. leaves- tunnel (direction).

Monitor:

Cars-north: Int ↔ #Coches yendo hacia el norte en el túnel

Cars-south: Int ↔ #coches yendo hacia el sur en el túnel

Someone-north: Condition

Someone-south: Condition

INV: cars_north ≥ 0 ∧ cars-south ≥ 0 ∧

∧ (¬ ((cars-north > 0 ∧ cars-south > 0))) ⊢

def wants-eat(direction):

$\{INV\}$

if direction == NORTH:

someone-south.wait(cars-south == 0)

$\{INV$ ∧ cars-south == 0$\}$

cars-north := cars-north + 1

$\{INV\}$

else: ↔ (direction == SOUTH)

someone-north.wait(cars-north == 0)

$\{INV$ ∧ cars-north == 0$\}$

cars-south := cars-south + 1

$\{INV\}$

$\{INV\}$

• INV ∧ cars-south == 0 ⟹ (cars-north ≥ 0 ∧ cars-south == 0 ∧

∧ (¬ ((cars-north > 0 ∧ cars-south > 0))) ⟹ cars-north ≥ 0 ∧ cars-south == 0)

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cierto

$\Rightarrow$ cars_north ≥ 1 $\wedge$ cars_south $== 0$ $\Rightarrow$

$\uparrow$
cars_north := cars_north+1

$\Rightarrow$ cars_north > 0 $\wedge$ cars_south $== 0$ $\Rightarrow$ INV $\checkmark$

Análogo al otro

$\bullet$ INV $\wedge$ cars_north $== 0$ $\overset{\smile}{\iff}$ cars_north $== 0$ $\wedge$ cars_south ≥ 0 $\Rightarrow$

$\Rightarrow$ cars_north $== 0$ $\wedge$ cars_south ≥ 1 $\Rightarrow$

$\uparrow$
cars_south := cars_south+1

(*) pues ($\wedge$ cars_north == 0)

$\Rightarrow$ cars_north $== 0$ $\wedge$ cars_south > 0 $\Rightarrow$ INV $\checkmark$

def (cars_tunnel (direction):

   $\{$INV $\wedge$ ((cars_north > 0 $\wedge$ cars_south $== 0$ $\wedge$ direction $==$ NORTH) $\oplus$ (cars_south > 0 $\wedge$ cars_north $== 0$ $\wedge$ direction $==$ SOUTH)) $\}$

   if direction $==$ NORTH:

      $\{$INV $\wedge$ cars_north > 0 $\wedge$ cars_south $== 0\}$

      cars_north := cars_north-1

      someone_north.signal()
      $\{$INV$\}$

   else: $\smile$ (direction $==$ SOUTH)

      $\{$INV $\wedge$ cars_south > 0 $\wedge$ (cars_north $== 0\}$

      cars_south := cars_south - 1

      someone_south.signal()
      $\{$INV$\}$

   $\{$INV$\}$

- $INV \wedge cars\_north > 0 \wedge cars\_south == 0 \iff$

$\iff cars\_north \geq 0 \wedge cars\_south \geq 0 \wedge [\neg(cars\_north > 0 \wedge$

$cars\_south > 0)] \wedge cars\_north > 0 \wedge cars\_south == 0 \iff$

$\underbrace{\qquad}_{\text{cierto}}$
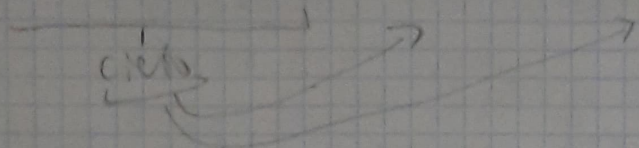
$\iff (cars\_north > 0 \wedge cars\_south == 0) \implies$

$cars\_north := cars\_north - 1$

$\implies cars\_north + 1 > 0 \wedge cars\_south == 0 \iff$

$\iff cars\_north \geq 0 \wedge cars\_south == 0 \overset{*2}{\implies} INV \checkmark$

- $INV \wedge cars\_south > 0 \wedge cars\_north == 0 \iff$ Análogo al otro caso

$\iff cars\_south > 0 \wedge cars\_north == 0 \quad \overset{1}{\implies}$

$cars\_south := cars\_south - 1$

$\implies cars\_south + 1 > 0 \wedge cars\_north == 0 \iff$

$\iff cars\_north \geq 0 \wedge cars\_south == 0 \implies INV \checkmark$

$\underbrace{(*)}_{} \text{por } cars\_north == 0$