

TÚNEL SOLUCIÓN BÁSICA

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TUNNEL SOLUCIÓN BÁSICA: demostración

car : Client

Loop

direction := random(NORTH, SOUTH)

monitor. wants_enter(direction)

monitor. leaves_tunnel(direction)

Monitor:

cars_north : Int \hookrightarrow # coches yendo hacia el norte en el túnel.

cars_south : Int \hookrightarrow # coches yendo hacia el sur en el túnel.

Someone_north : condition

Someone_south : condition

$\vdash INV: cars_north \geq 0 \wedge cars_south \geq 0 \wedge (\neg (cars_north > 0 \wedge cars_south > 0)) \vdash$

def wants_enter(direction):

$\vdash INV \vdash$

If direction == NORTH

Someone_south.wait(cars_south == 0)

$\vdash INV \wedge cars_south == 0 \vdash$

cars_north := cars_north + 1

$\vdash INV \vdash$

else : \hookrightarrow (direction == SOUTH)

Someone_north.wait(cars_north == 0)

$\vdash INV \wedge cars_north == 0 \vdash$

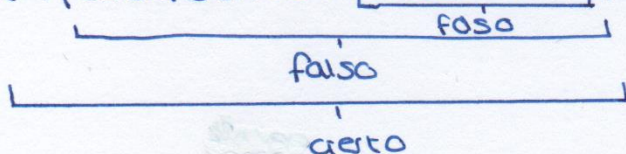
cars_south := cars_south + 1

$\vdash INV \vdash$

$\vdash INV \vdash$

• $INV \wedge cars_south == 0 \Leftrightarrow cars_north \geq 0 \wedge cars_south == 0 \wedge$

$\wedge (\neg (cars_north > 0 \wedge cars_south > 0)) \Leftrightarrow cars_north \geq 0 \wedge cars_south == 0 \Rightarrow$



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Las primeras dos términos de la conjunción se siguen reduciendo y a última porque cars_south == 0

$\Rightarrow cars_north \geq 1 \wedge cars_south == 0 \Rightarrow cars_north > 0 \wedge cars_south == 0 \Rightarrow INV \checkmark$

\downarrow
cars_north := cars_north + 1

$\bullet \text{ INV} \wedge \text{cars_north} == 0 \Leftrightarrow \text{cars_north} == 0 \wedge \text{cars_south} \geq 0 \Rightarrow \text{cars_north} == 0 \wedge$
 $\wedge \text{cars_south} \geq 1 \Rightarrow \text{cars_north} == 0 \wedge \text{cars_south} > 0 \Rightarrow \text{INV} \checkmark$
 \downarrow

\bullet pero con $\text{cars_north} == 0$

def leave_tunnel(direction):

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

$\oplus (\text{cars_south} > 0 \wedge \text{cars_north} == 0 \wedge \text{direction} == \text{SOUTH})) \vdash$

if direction == NORTH:

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

$\text{cars_north} := \text{cars_north} - 1$

someone_north.signal()

$\vdash \text{INV} \vdash$

else: \hookrightarrow (direction == SOUTH)

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

$\text{cars_south} := \text{cars_south} - 1$

someone_south.signal()

$\vdash \text{INV} \vdash$

$\vdash \text{INV} \vdash$

$\bullet \text{ INV} \wedge \text{cars_north} > 0 \wedge \text{cars_south} == 0 \Leftrightarrow \text{cars_north} \geq 0 \wedge \text{cars_south} \geq 0 \wedge$
 $\wedge (\neg (\text{cars_north} > 0 \wedge \text{cars_south} > 0)) \wedge \text{cars_north} > 0 \wedge \text{cars_south} == 0 \Leftrightarrow$

$\Leftrightarrow \text{cars_north} > 0 \wedge \text{cars_south} == 0 \Rightarrow \text{cars_north} + 1 > 0 \wedge \text{cars_south} == 0 \Leftrightarrow$

\downarrow
 $\text{cars_north} := \text{cars_north} - 1$

$\Leftrightarrow \text{cars_north} \geq 0 \wedge \text{cars_south} == 0 \Rightarrow \text{INV} \checkmark$

\bullet

$\bullet \text{ INV} \wedge \text{cars_south} > 0 \wedge \text{cars_north} == 0 \Leftrightarrow \text{cars_south} > 0 \wedge \text{cars_north} == 0 \Rightarrow$

$\Rightarrow \text{cars_south} + 1 > 0 \wedge \text{cars_north} == 0 \Leftrightarrow \text{cars_south} \geq 0 \wedge \text{cars_north} == 0 \Rightarrow \text{INV} \checkmark$

\downarrow
 $\text{cars_south} := \text{cars_south} - 1$

\bullet pero $\text{cars_north} == 0$