NaturalSemantics.pdf

Juanma21_

Teoría de Los Lenguajes de Programación

4º Grado en Ingeniería Informática

Escuela Técnica Superior de Ingeniería Informática
Universidad de Málaga

NaturalSemantics.hs

```haskell
-- ------------------------------------------------------------------
-- Natural Semantics for WHILE 2020.
-- Examen de Lenguajes de Programación. UMA.
--
-- Apellidos, Nombre: Cardeñosa Borrego, Juan Manuel
-- ------------------------------------------------------------------

module NaturalSemantics where

import           While20

updateState :: State -> Var -> Z -> State
updateState s x v y = if x == y then v else s y

-- representation of configurations for While

data Config = Inter Stm State  -- <S, s>
            | Final State      -- s

-- representation of the transition relation <S, s> -> s'

nsStm :: Config -> Config

-- x := a

nsStm (Inter (Ass x a) s) = Final (updateState s x (aVal a s))

-- skip

nsStm (Inter Skip s) = Final s

-- s1; s2

nsStm (Inter (Comp ss1 ss2) s) = Final s''
  where
    Final s'  = nsStm (Inter ss1 s)
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-- if b then s1 else s2

nsStm (Inter (If b ss1 ss2) s)
  | bVal b s = Final s'
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-- NO MODIFICAR EL CODIGO DE ARRIBA
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{-
                          <x := y, s> -> s'
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-- Sentencia Swap
nsStm (Inter (Swap x y) s) = Final (updateState s1 y (s x))
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Si es True
              <s1, s> -> s' <s3, s'> -> s''  <s2, s''> -> s'''  <For Skip b s2 s3, s'''> ->
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----- if B[b]s = True
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Si es False
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nsStm(Inter (For s1 b s2 s3) s) | bVal b s = Final s''''
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reduce :: Aexp -> Aexp

-- Entero
reduce (N n) = (N n)

-- Variable
reduce (V x) = (V x)

-- Suma 1
```

1/6

Este número es indicativo del riesgo del producto, siendo 1/6 indicativo de menor riesgo y 6/6 de mayor riesgo.

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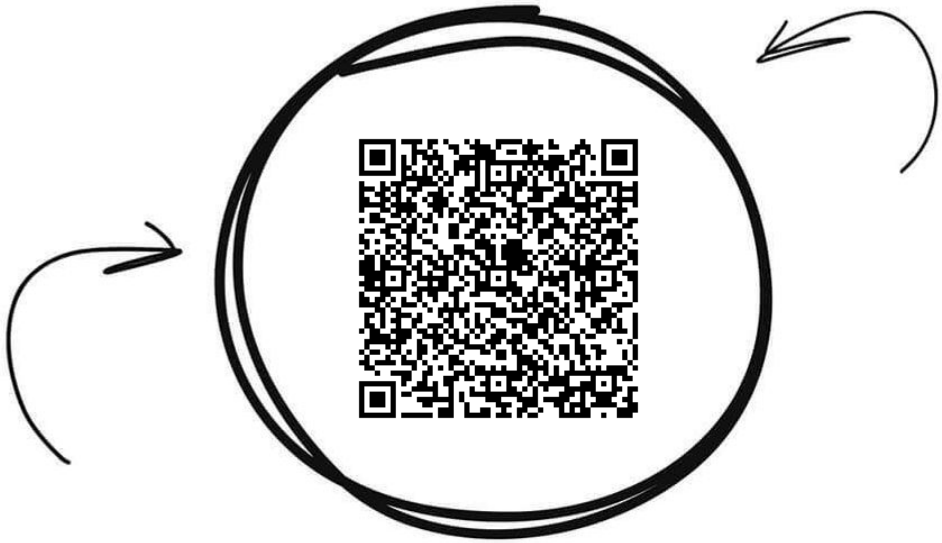

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3. Coloca en un lugar visible para que tus compis puedan escanar y acceder a apuntes
4. Llévate dinero por cada descarga de los documentos descargados a través de tu QR

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reduce (Add (N n1) (N n2)) = reduce (N (n1 + n2))

-- Suma 2
reduce (Add a1 a2) = Add (reduce a1') (reduce a2')
  where
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-- Resta 1
reduce (Sub (N n1) (N n2)) = reduce (N (n1 - n2))

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exp1 :: Aexp
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-- exp1 = ((3 + 6) + (x)) * ((4 * 8) - y)
-- reduce exp1
-- Solucion: (9 + x) * (32 - y)

exp2 :: Aexp
exp2 = Add (V "x") (Mult (N 5) (N 3))
-- exp2 = x + (5 * 3)
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-- Solucion: x + 15

exp3 :: Aexp
exp3 = Add (Mult (N 8) (V "y")) (Add (Mult (N 3) (N 2)) (N 5))
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exp4 :: Aexp
exp4 = Add (Mult (N 8) (V "y")) (Add (Mult (Mult (N 4) (Mult (N 2) (Mult (N 3) (N 4)))) (N 2)) (N 5))
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s1 :: State
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    a2' = reduce a2


-- Mult 1
reduce (Mult (N n1) (N n2)) = reduce (N (n1 * n2))

-- Mult 2
reduce (Mult a1 a2) = Mult (reduce a1') (reduce a2')
  where
    a1' = reduce a1
    a2' = reduce a2


exp1 :: Aexp
exp1 = Mult (Add (Add (N 3) (N 6)) (V "x")) (Sub (Mult (N 4) (N 8)) (V "y"))
-- exp1 = ((3 + 6) + (x)) * ((4 * 8) - y)
-- reduce exp1
-- Solucion: (9 + x) * (32 - y)

exp2 :: Aexp
exp2 = Add (V "x") (Mult (N 5) (N 3))
-- exp2 = x + (5 * 3)
-- reduce exp2
-- Solucion: x + 15

exp3 :: Aexp
exp3 = Add (Mult (N 8) (V "y")) (Add (Mult (N 3) (N 2)) (N 5))
-- exp3 = (8* y) + ((3 + 2) * 5)
-- reduce exp3
-- Solucion: (8 * y) + 11

exp4 :: Aexp
exp4 = Add (Mult (N 8) (V "y")) (Add (Mult (Mult (N 4) (Mult (N 2) (Mult (N 3) (N 4)))) (N 2)) (N 5))
-- exp4 = (8 * y) + ((4 * (2 * (3 * 2))) + 5)
-- reduce exp4
-- Solucion: (8 * y) + 197

```

```haskell
-- Swap como funcion para probar, se pide el stm (arriba está hecho)
s1 :: State
s1 "x" = 3
s1 "y" = 4

exp5 :: Aexp
exp5 = Add (Mult (V "x") (N 5) ) (V "y")

-- aVal exp5 s1
-- Da 19
-- aVal exp5 (swap s1 "x" "y")
-- Da 23
```

NaturalSemantics.hs

```haskell
-- ------------------------------------------------------------------
-- Natural Semantics for WHILE 2020.
-- Examen de Lenguajes de Programación. UMA.
--
-- Apellidos, Nombre: Cardeñosa Borrego, Juan Manuel
-- ------------------------------------------------------------------

module NaturalSemantics where

import           While20

updateState :: State -> Var -> Z -> State
updateState s x v y = if x == y then v else s y

-- representation of configurations for While

data Config = Inter Stm State  -- <S, s>
            | Final State      -- s

-- representation of the transition relation <S, s> -> s'

nsStm :: Config -> Config

-- x := a

nsStm (Inter (Ass x a) s) = Final (updateState s x (aVal a s))

-- skip

nsStm (Inter Skip s) = Final s

-- s1; s2

nsStm (Inter (Comp ss1 ss2) s) = Final s''
  where
    Final s'  = nsStm (Inter ss1 s)
    Final s'' = nsStm (Inter ss2 s')

-- if b then s1 else s2

nsStm (Inter (If b ss1 ss2) s)
  | bVal b s = Final s'
  where
    Final s' = nsStm (Inter ss1 s)

nsStm (Inter (If b ss1 ss2) s)
  | not(bVal b s) = Final s'
  where
    Final s' = nsStm (Inter ss2 s)

-- ------------------------------------------------------------------
```

```haskell
-- NO MODIFICAR EL CODIGO DE ARRIBA
-----------------------------------------------------------------------

{-
                          <x := y, s> -> s'
 [swap ns] ------------------------------------------------
                <Swap x y, s> -> s'[y -> A[x]s]
-}

-- Sentencia Swap
nsStm (Inter (Swap x y) s) = Final (updateState s1 y (s x))
  where
    Final s1 = nsStm (Inter (Ass x (V y)) s)

{-

Si es True
              <s1, s> -> s' <s3, s'> -> s''  <s2, s''> -> s'''  <For Skip b s2 s3, s'''> ->
s''''
 [for ns] ------------------------------------------------------------------------------
----- if B[b]s = True
                                                <For s1 b s2 s3, s> -> s''''

Si es False
                       <s1,s> -> s'
  [for ns] ------------------------------------ if B[b]s = False
                <For s1 b s2 s3, s> -> s'

-}

-- Sentencia for
-- Si es true
nsStm(Inter (For s1 b s2 s3) s) | bVal b s = Final s''''
  where
    Final s'    = nsStm (Inter s1 s)
    Final s''   = nsStm (Inter s3 s')
    Final s'''  = nsStm (Inter s2 s'')
    Final s'''' = nsStm (Inter (For Skip b s2 s3) s''')

-- Si es false
nsStm(Inter (For s1 b s2 s3) s) | not(bVal b s) = Final s'
  where
    Final s'    = nsStm (Inter s1 s)


reduce :: Aexp -> Aexp

-- Entero
reduce (N n) = (N n)

-- Variable
reduce (V x) = (V x)

-- Suma 1
```

```haskell
reduce (Add (N n1) (N n2)) = reduce (N (n1 + n2))

-- Suma 2
reduce (Add a1 a2) = Add (reduce a1') (reduce a2')
  where
    a1' = reduce a1
    a2' = reduce a2


-- Resta 1
reduce (Sub (N n1) (N n2)) = reduce (N (n1 - n2))

-- Resta 2
reduce (Sub a1 a2) = Sub (reduce a1') (reduce a2')
  where
    a1' = reduce a1
    a2' = reduce a2


-- Mult 1
reduce (Mult (N n1) (N n2)) = reduce (N (n1 * n2))

-- Mult 2
reduce (Mult a1 a2) = Mult (reduce a1') (reduce a2')
  where
    a1' = reduce a1
    a2' = reduce a2


exp1 :: Aexp
exp1 = Mult (Add (Add (N 3) (N 6)) (V "x")) (Sub (Mult (N 4) (N 8)) (V "y"))
-- exp1 = ((3 + 6) + (x)) * ((4 * 8) - y)
-- reduce exp1
-- Solucion: (9 + x) * (32 - y)

exp2 :: Aexp
exp2 = Add (V "x") (Mult (N 5) (N 3))
-- exp2 = x + (5 * 3)
-- reduce exp2
-- Solucion: x + 15

exp3 :: Aexp
exp3 = Add (Mult (N 8) (V "y")) (Add (Mult (N 3) (N 2)) (N 5))
-- exp3 = (8* y) + ((3 + 2) * 5)
-- reduce exp3
-- Solucion: (8 * y) + 11

exp4 :: Aexp
exp4 = Add (Mult (N 8) (V "y")) (Add (Mult (Mult (N 4) (Mult (N 2) (Mult (N 3) (N 4)))) (N 2)) (N 5))
-- exp4 = (8 * y) + ((4 * (2 * (3 * 2))) + 5)
-- reduce exp4
-- Solucion: (8 * y) + 197

```

```haskell
-- Swap como funcion para probar, se pide el stm (arriba está hecho)
s1 :: State
s1 "x" = 3
s1 "y" = 4

exp5 :: Aexp
exp5 = Add (Mult (V "x") (N 5) ) (V "y")

-- aVal exp5 s1
-- Da 19
-- aVal exp5 (swap s1 "x" "y")
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```

NaturalSemantics.hs

```haskell
-- ------------------------------------------------------------------
-- Natural Semantics for WHILE 2020.
-- Examen de Lenguajes de Programación. UMA.
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module NaturalSemantics where

import           While20

updateState :: State -> Var -> Z -> State
updateState s x v y = if x == y then v else s y

-- representation of configurations for While

data Config = Inter Stm State  -- <S, s>
            | Final State      -- s

-- representation of the transition relation <S, s> -> s'

nsStm :: Config -> Config

-- x := a

nsStm (Inter (Ass x a) s) = Final (updateState s x (aVal a s))

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nsStm (Inter Skip s) = Final s

-- s1; s2

nsStm (Inter (Comp ss1 ss2) s) = Final s''
  where
    Final s'  = nsStm (Inter ss1 s)
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-- if b then s1 else s2

nsStm (Inter (If b ss1 ss2) s)
  | bVal b s = Final s'
  where
    Final s' = nsStm (Inter ss1 s)

nsStm (Inter (If b ss1 ss2) s)
  | not(bVal b s) = Final s'
  where
    Final s' = nsStm (Inter ss2 s)

-- ------------------------------------------------------------------
```

```haskell
-- NO MODIFICAR EL CODIGO DE ARRIBA
-----------------------------------------------------------------------

{-
                          <x := y, s> -> s'
 [swap ns] ------------------------------------------------
                <Swap x y, s> -> s'[y -> A[x]s]
-}

-- Sentencia Swap
nsStm (Inter (Swap x y) s) = Final (updateState s1 y (s x))
  where
    Final s1 = nsStm (Inter (Ass x (V y)) s)

{-

Si es True
              <s1, s> -> s' <s3, s'> -> s''  <s2, s''> -> s'''  <For Skip b s2 s3, s'''> ->
s''''
 [for ns] ------------------------------------------------------------------------------
----- if B[b]s = True
                                                  <For s1 b s2 s3, s> -> s''''

Si es False
                       <s1,s> -> s'
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-- Sentencia for
-- Si es true
nsStm(Inter (For s1 b s2 s3) s) | bVal b s = Final s''''
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reduce (Add a1 a2) = Add (reduce a1') (reduce a2')
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-- Resta 1
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-- Resta 2
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reduce (Mult (N n1) (N n2)) = reduce (N (n1 * n2))

-- Mult 2
reduce (Mult a1 a2) = Mult (reduce a1') (reduce a2')
  where
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exp1 :: Aexp
exp1 = Mult (Add (Add (N 3) (N 6)) (V "x")) (Sub (Mult (N 4) (N 8)) (V "y"))
-- exp1 = ((3 + 6) + (x)) * ((4 * 8) - y)
-- reduce exp1
-- Solucion: (9 + x) * (32 - y)

exp2 :: Aexp
exp2 = Add (V "x") (Mult (N 5) (N 3))
-- exp2 = x + (5 * 3)
-- reduce exp2
-- Solucion: x + 15

exp3 :: Aexp
exp3 = Add (Mult (N 8) (V "y")) (Add (Mult (N 3) (N 2)) (N 5))
-- exp3 = (8* y) + ((3 + 2) * 5)
-- reduce exp3
-- Solucion: (8 * y) + 11

exp4 :: Aexp
exp4 = Add (Mult (N 8) (V "y")) (Add (Mult (Mult (N 4) (Mult (N 2) (Mult (N 3) (N 4)))) (N 2)) (N 5))
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-- Swap como funcion para probar, se pide el stm (arriba está hecho)
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nsStm (Inter (If b ss1 ss2) s)
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  | not(bVal b s) = Final s'
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-- ------------------------------------------------------------------
```

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-- NO MODIFICAR EL CODIGO DE ARRIBA
-----------------------------------------------------------------------

{-
                          <x := y, s> -> s'
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                <Swap x y, s> -> s'[y -> A[x]s]
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-- Sentencia Swap
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Si es True
              <s1, s> -> s' <s3, s'> -> s''  <s2, s''> -> s'''  <For Skip b s2 s3, s'''> ->
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nsStm(Inter (For s1 b s2 s3) s) | bVal b s = Final s''''
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-- Resta 2
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reduce (Mult (N n1) (N n2)) = reduce (N (n1 * n2))

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-- Solucion: (9 + x) * (32 - y)

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-- Solucion: x + 15

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exp3 = Add (Mult (N 8) (V "y")) (Add (Mult (N 3) (N 2)) (N 5))
-- exp3 = (8* y) + ((3 + 2) * 5)
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-- Solucion: (8 * y) + 11

exp4 :: Aexp
exp4 = Add (Mult (N 8) (V "y")) (Add (Mult (Mult (N 4) (Mult (N 2) (Mult (N 3) (N 4)))) (N 2)) (N 5))
-- exp4 = (8 * y) + ((4 * (2 * (3 * 2))) + 5)
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-- Swap como funcion para probar, se pide el stm (arriba está hecho)
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