

Segunda parte (ex.4)

De EjerciciosLMF2014

```
header {* Examen 4 *}
```

```
theory ex4_sol
imports Main
begin
```

```
text {* -----
Ejercicio 2: (3 puntos) Demostrar
{  $\exists x. \forall y. B(y) \rightarrow A(x,y), \exists x. \forall y. (\forall z. B(z) \rightarrow A(y,z)) \rightarrow \neg S(x,y)$  }  $\vdash$ 
 $\exists x. \neg(\forall y. S(x,y))$ 
----- *}

```

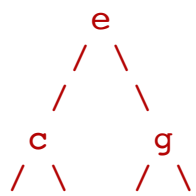
```
lemma ej_2:
  assumes " $\exists x. \forall y. B(y) \rightarrow A(x,y)$ "
          " $\exists x. \forall y. (\forall z. B(z) \rightarrow A(y,z)) \rightarrow \neg S(x,y)$ "
  shows " $\exists x. \neg(\forall y. S(x,y))$ "
proof -
  obtain p where 1: " $\forall y. B(y) \rightarrow A(p,y)$ " using assms(1) ..
  obtain q where 2: " $\forall y. (\forall z. B(z) \rightarrow A(y,z)) \rightarrow \neg S(q,y)$ " using assms(2) ..
  hence 3: " $(\forall z. B(z) \rightarrow A(p,z)) \rightarrow \neg S(q,p)$ " ..
  hence 4: " $\neg S(q,p)$ " using 1 ..
  have 5: " $\neg(\forall y. S(q,y))$ "
  proof
    assume 6: " $\forall y. S(q,y)$ "
    hence 7: " $S(q,p)$ " ..
    with 4 show False ..
  qed
  thus 8: " $\exists x. \neg(\forall y. S(x,y))$ " ..
qed

```

```
text {* -----
Ejercicio 3: (4 puntos) Consideremos el árbol binario definido por
datatype 'a arbol = H | N "'a" "'a arbol" "'a arbol"

```

Por ejemplo, el árbol



se representa por " $N\ e\ (N\ c\ H\ H)\ (N\ g\ H\ H)$ ".



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```
fun nNodos :: "'a arbol  $\Rightarrow$  nat" where
```

```
text {*
```

```
-----  
(b) Definir la función
```

```
fun nHojas :: "'a arbol ⇒ nat"
```

```
tal que (nHojas a) es el número de hojas de a. Por ejemplo,
```

```
nHojas (N e (N c H H) (N g H H)) = 4  
-----
```

```
*}
```

```
fun nHojas :: "'a arbol ⇒ nat" where
```

```
"nHojas H = 1"
```

```
| "nHojas (N x i d) = (nHojas i) + (nHojas d)"
```

```
text {*
```

```
-----  
(c) Probar que el número de hojas de un árbol es el número de nodos  
más 1.  
-----
```

```
*}
```

```
lemma "nHojas a = (nNodos a) + 1"
```

```
by (induct a) auto
```

```
lemma "nHojas a = (nNodos a) + 1" (is "?P a")
```

```
proof (induct a)
```

```
show "?P H" by simp
```

```
next
```

```
fix x i d
```

```
assume HI1: "?P i"
```

```
assume HI2: "?P d"
```

```
show "?P (N x i d)"
```

```
proof -
```

```
have "nHojas (N x i d) = (nHojas i) + (nHojas d)" by simp
```

```
also have "... = (nNodos i) + 1 + (nNodos d) + 1" using HI1 HI2 by simp
```

```
also have "... = (nNodos i) + (nNodos d) + 1 + 1" using HI1 HI2 by simp
```

```
also have "... = (nNodos (N x i d)) + 1" by simp
```

```
finally show ?thesis by simp
```

```
qed
```

```
qed
```

```
end
```

Obtenido de "[http://www.glc.us.es/~jalonso/ejerciciosLMF2014/index.php5/Segunda_parte_\(ex.4\)](http://www.glc.us.es/~jalonso/ejerciciosLMF2014/index.php5/Segunda_parte_(ex.4))"

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, blue, serif font. The '99' is significantly larger and more prominent than the 'Cartagena' part. The text is set against a light blue background with a subtle gradient and a soft shadow effect.

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