7524 - Teoría de la programación

TP Individual

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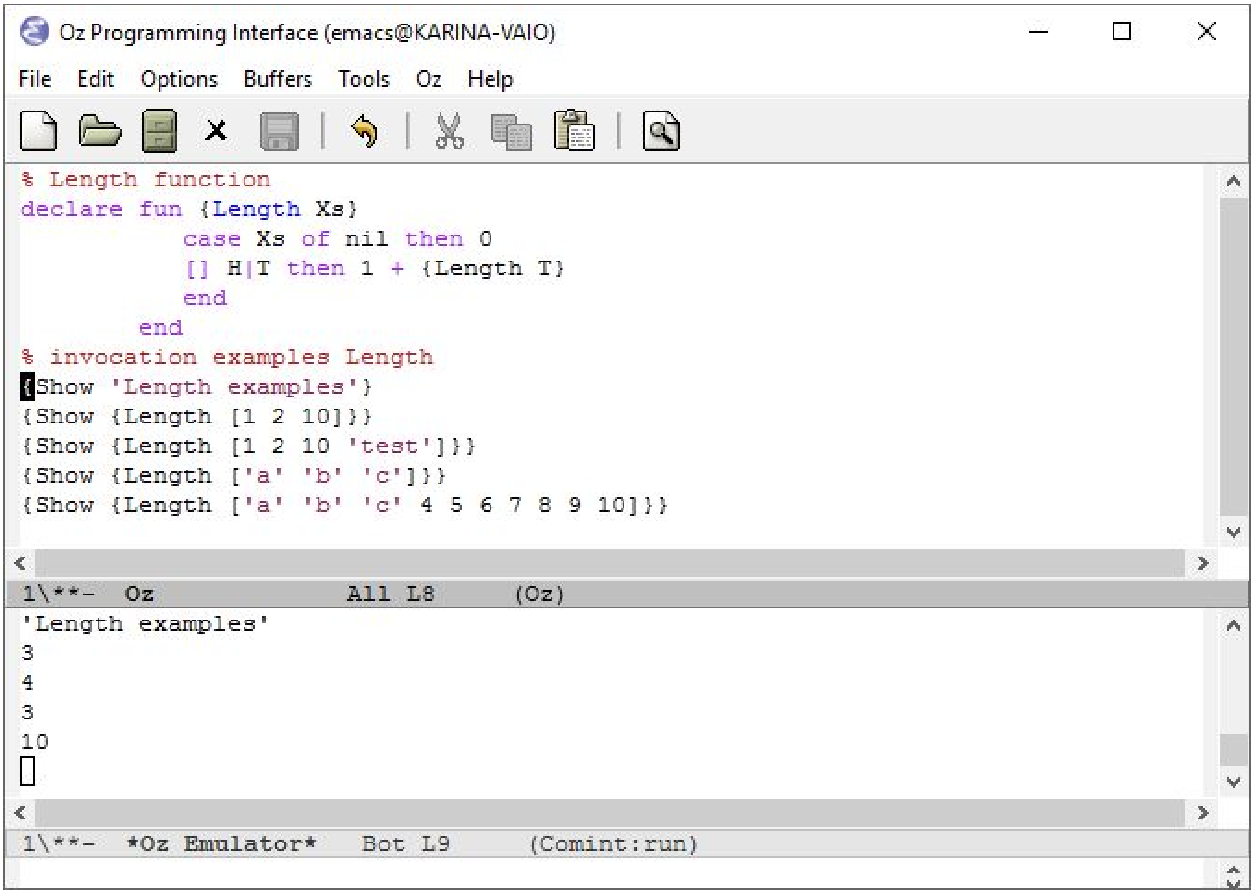
Ejercicio 1) - Procesamiento de listas

1. Length

a. Código Oz

```
% Length function
declare fun {Length Xs}
        case Xs of nil then 0
        [] H|T then 1 + {Length T}
        end
     end
```

b. Ejemplos de ejecución


Oz Programming Interface (emacs@KARINA-VAIO)
File Edit Options Buffers Tools Oz Help

```
% Length function
declare fun {Length Xs}
           case Xs of nil then 0
           [] H|T then 1 + {Length T}
           end
        end
% invocation examples Length
{Show 'Length examples'}
{Show {Length [1 2 10]}}
{Show {Length [1 2 10 'test']}}
{Show {Length ['a' 'b' 'c']}}
{Show {Length ['a' 'b' 'c' 4 5 6 7 8 9 10]}}
```

1**- Oz   All L8   (Oz)

```
'Length examples'
3
4
3
10
```

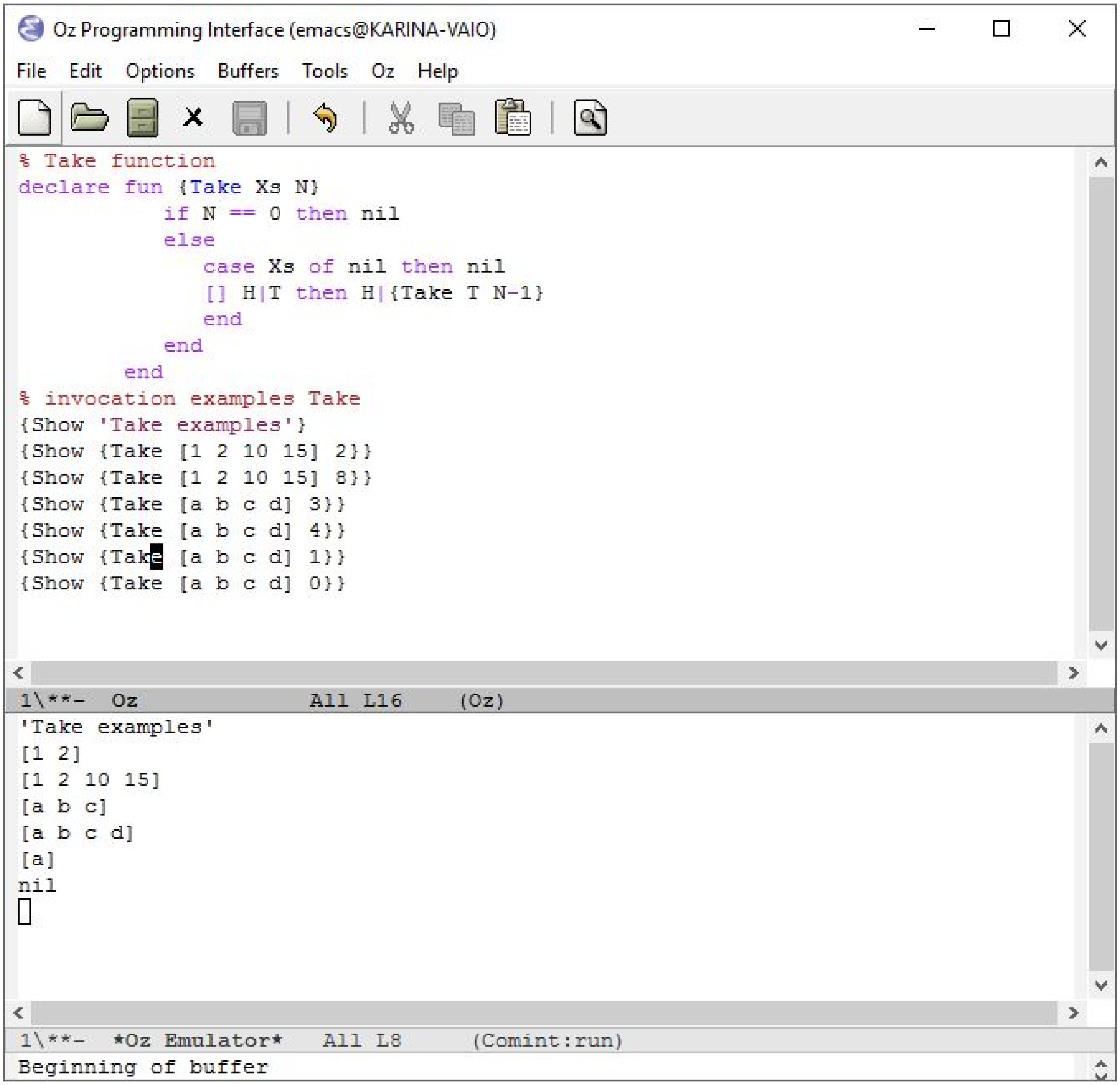
1**- *Oz Emulator*   Bot L9   (Comint:run)

2. Take

a. Código Oz

```
% Take function
declare fun {Take Xs N}
        if N == 0 then nil
        else
           case Xs of nil then nil
           [] H|T then H|{Take T N-1}
           end
        end
     end
```

b. Ejemplos de ejecución



Oz Programming Interface (emacs@KARINA-VAIO)
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```
% Take function
declare fun {Take Xs N}
           if N == 0 then nil
           else
              case Xs of nil then nil
              [] H|T then H|{Take T N-1}
              end
           end
        end
% invocation examples Take
{Show 'Take examples'}
{Show {Take [1 2 10 15] 2}}
{Show {Take [1 2 10 15] 8}}
{Show {Take [a b c d] 3}}
{Show {Take [a b c d] 4}}
{Show {Take [a b c d] 1}}
{Show {Take [a b c d] 0}}
```

1**- Oz   All L16   (Oz)

```
'Take examples'
[1 2]
[1 2 10 15]
[a b c]
[a b c d]
[a]
nil
```

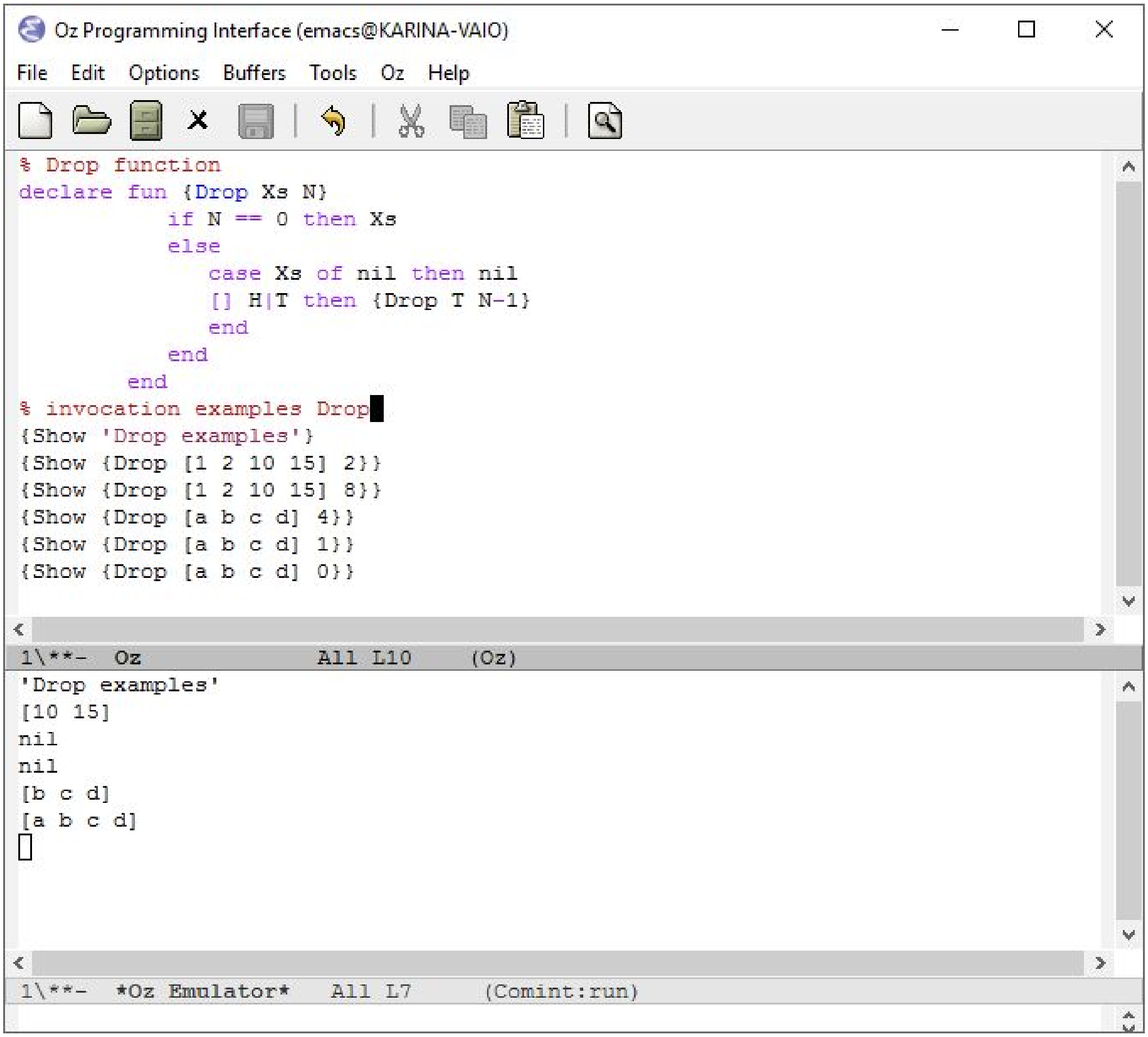
1**- *Oz Emulator*   All L8   (Comint:run)
Beginning of buffer

3. Drop

a. Código Oz

```
% Drop function
declare fun {Drop Xs N}
         if N == 0 then Xs
         else
            case Xs of nil then nil
            [] H|T then {Drop T N-1}
            end
         end
      end
```

b. Ejemplos de ejecución


Oz Programming Interface (emacs@KARINA-VAIO)
File Edit Options Buffers Tools Oz Help

```
% Drop function
declare fun {Drop Xs N}
           if N == 0 then Xs
           else
              case Xs of nil then nil
              [] H|T then {Drop T N-1}
              end
           end
        end
% invocation examples Drop
{Show 'Drop examples'}
{Show {Drop [1 2 10 15] 2}}
{Show {Drop [1 2 10 15] 8}}
{Show {Drop [a b c d] 4}}
{Show {Drop [a b c d] 1}}
{Show {Drop [a b c d] 0}}
```

1**- Oz   All L10   (Oz)

```
'Drop examples'
[10 15]
nil
nil
[b c d]
[a b c d]
```

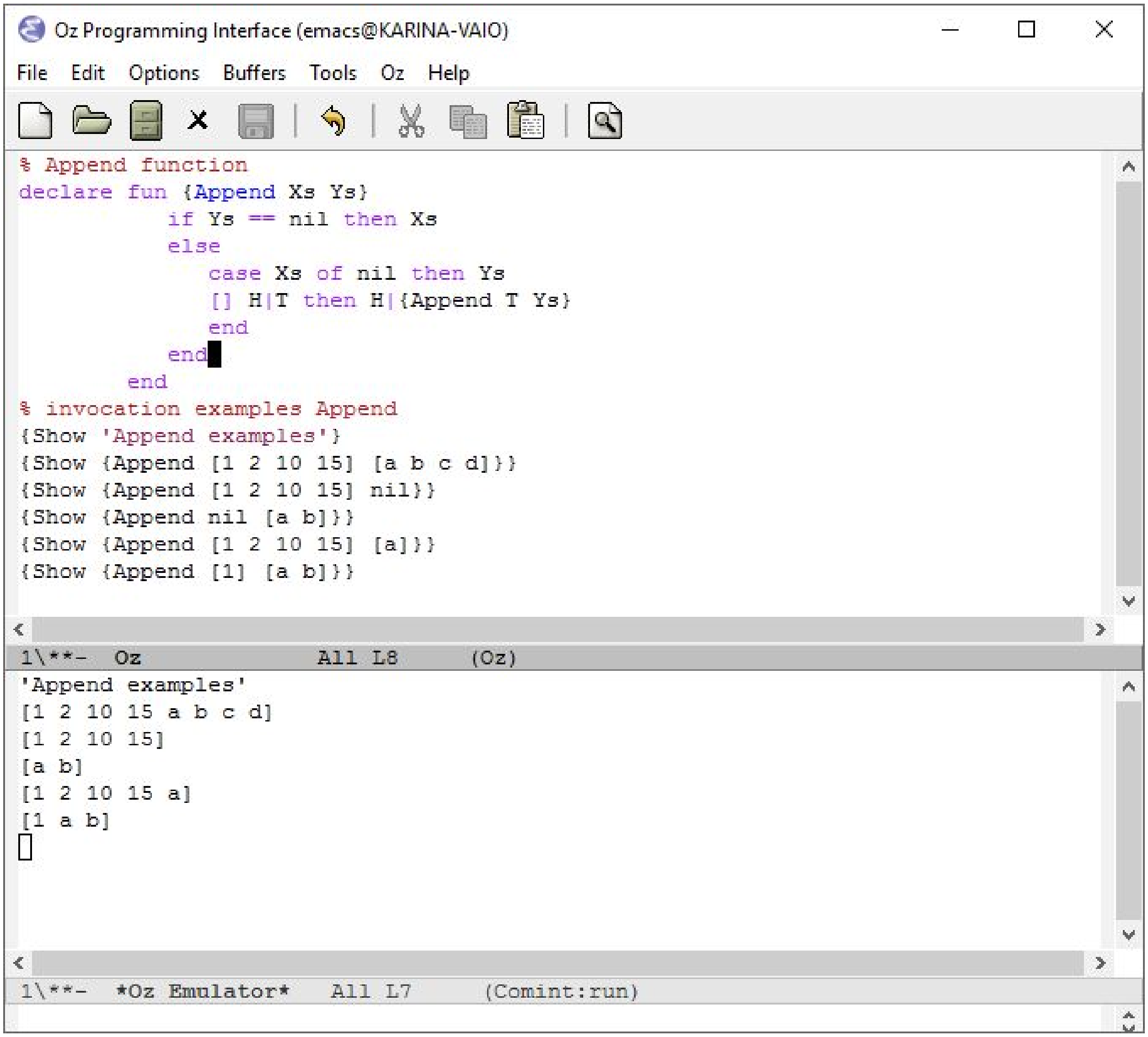
1**- *Oz Emulator*   All L7   (Comint:run)

4. Append

a. Código Oz

```
% Append function
declare fun {Append Xs Ys}
         if Ys == nil then Xs
         else
            case Xs of nil then Ys
            [] H|T then H|{Append T Ys}
            end
         end
      end
```

b. Ejemplos de ejecución



Oz Programming Interface (emacs@KARINA-VAIO)
File Edit Options Buffers Tools Oz Help

```
% Append function
declare fun {Append Xs Ys}
           if Ys == nil then Xs
           else
              case Xs of nil then Ys
              [] H|T then H|{Append T Ys}
              end
           end
        end
% invocation examples Append
{Show 'Append examples'}
{Show {Append [1 2 10 15] [a b c d]}}
{Show {Append [1 2 10 15] nil}}
{Show {Append nil [a b]}}
{Show {Append [1 2 10 15] [a]}}
{Show {Append [1] [a b]}}
```

1**- Oz   All L8   (Oz)

```
'Append examples'
[1 2 10 15 a b c d]
[1 2 10 15]
[a b]
[1 2 10 15 a]
[1 a b]
```

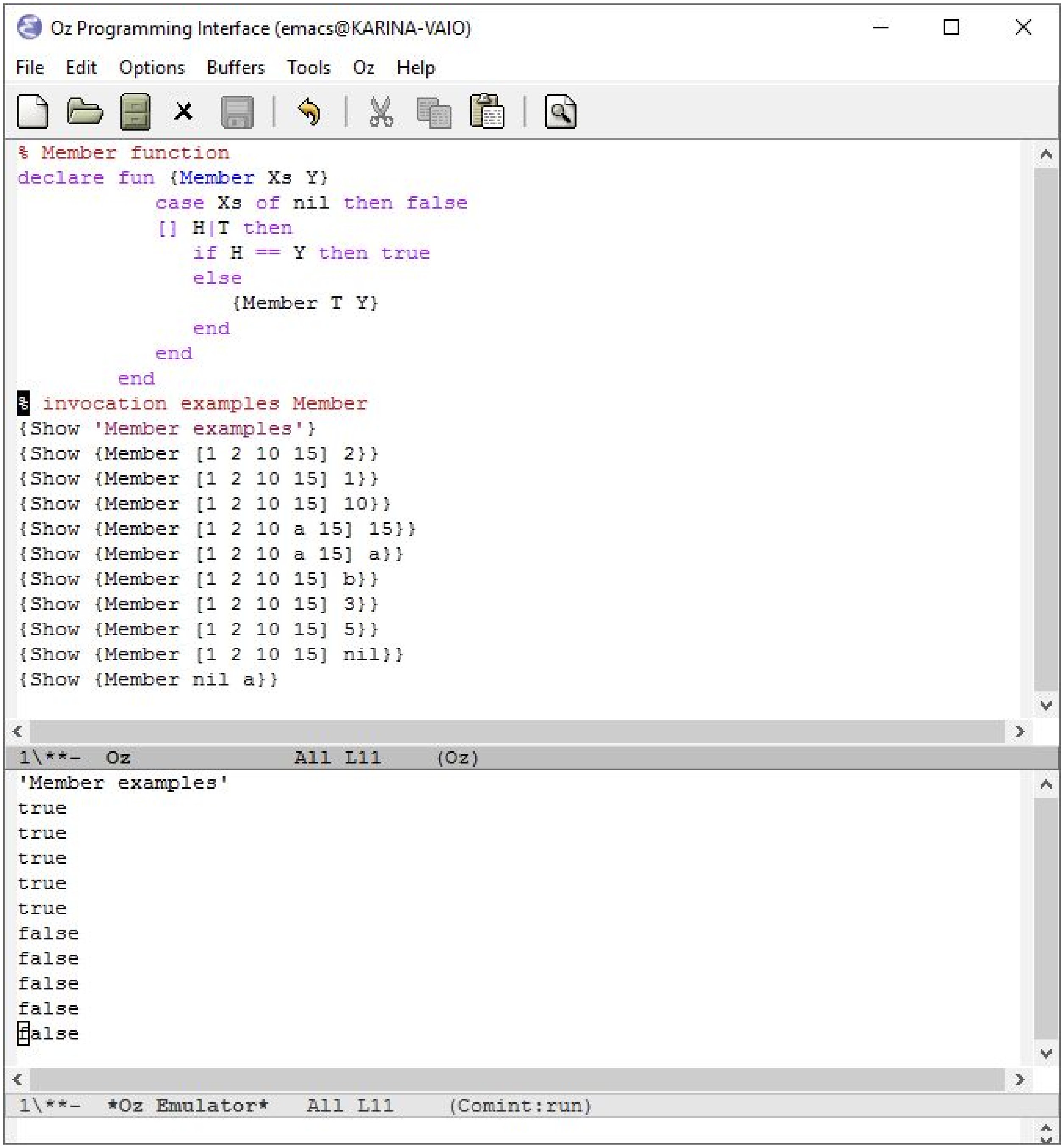
1**- *Oz Emulator*   All L7   (Comint:run)

5. Member

a. Código Oz

```
% Member function
declare fun {Member Xs Y}
         case Xs of nil then false
         [] H|T then
            if H == Y then true
            else
             {Member T Y}
            end
         end
      end
```

b. Ejemplos de ejecución


Oz Programming Interface (emacs@KARINA-VAIO)
File Edit Options Buffers Tools Oz Help

```
% Member function
declare fun {Member Xs Y}
           case Xs of nil then false
           [] H|T then
              if H == Y then true
              else
                 {Member T Y}
              end
           end
        end
% invocation examples Member
{Show 'Member examples'}
{Show {Member [1 2 10 15] 2}}
{Show {Member [1 2 10 15] 1}}
{Show {Member [1 2 10 15] 10}}
{Show {Member [1 2 10 a 15] 15}}
{Show {Member [1 2 10 a 15] a}}
{Show {Member [1 2 10 15] b}}
{Show {Member [1 2 10 15] 3}}
{Show {Member [1 2 10 15] 5}}
{Show {Member [1 2 10 15] nil}}
{Show {Member nil a}}
```

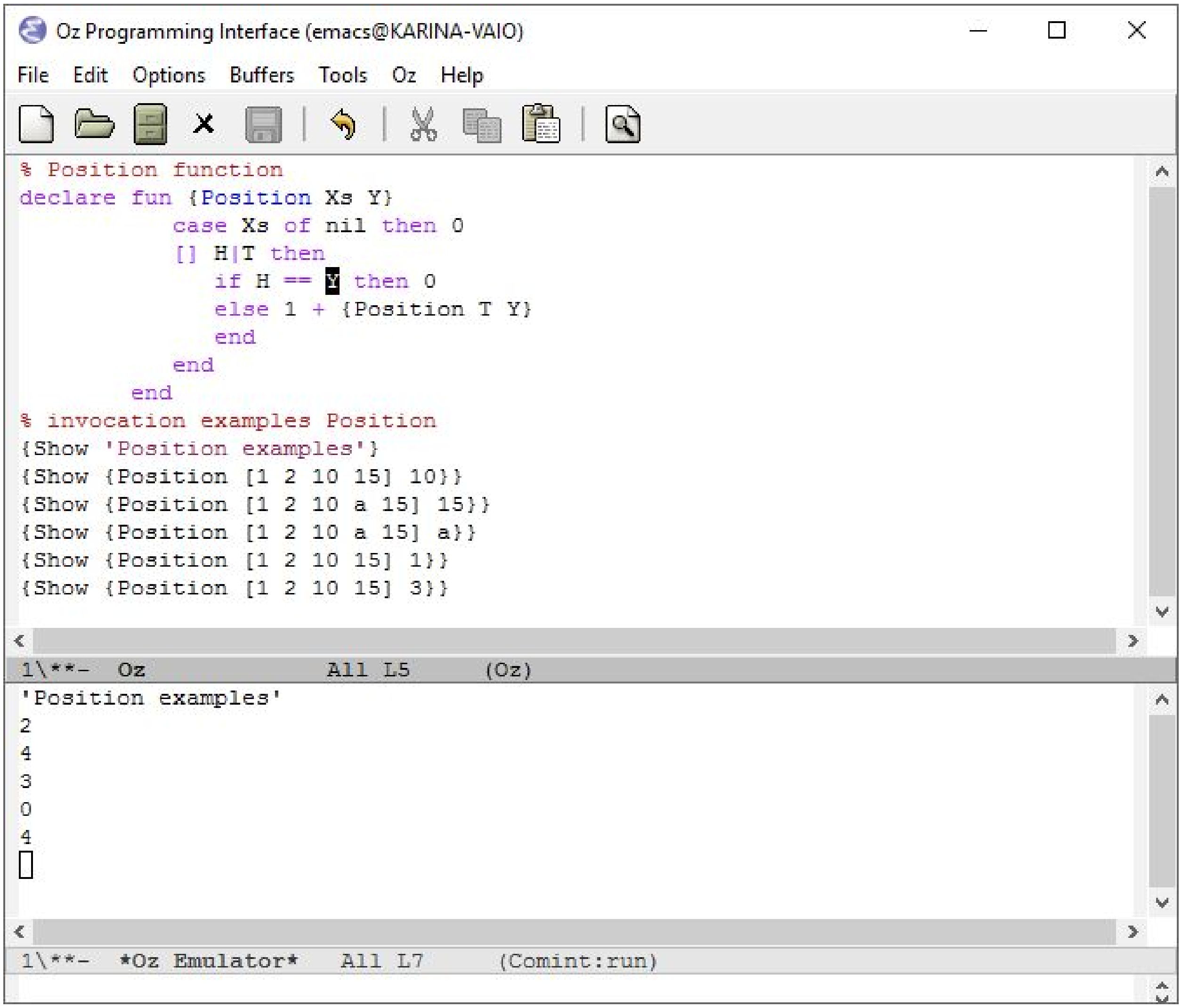
```
'Member examples'
true
true
true
true
true
false
false
false
false
false
```

6. Position

a. Código Oz

```
% Position function
declare fun {Position Xs Y}
         case Xs of nil then 0
         [] H|T then
            if H == Y then 0
            else 1 + {Position T Y}
            end
         end
      end
```

b. Ejemplos de ejecución



Oz Programming Interface (emacs@KARINA-VAIO)
File Edit Options Buffers Tools Oz Help

```
% Position function
declare fun {Position Xs Y}
           case Xs of nil then 0
           [] H|T then
              if H == Y then 0
              else 1 + {Position T Y}
              end
           end
        end
% invocation examples Position
{Show 'Position examples'}
{Show {Position [1 2 10 15] 10}}
{Show {Position [1 2 10 a 15] 15}}
{Show {Position [1 2 10 a 15] a}}
{Show {Position [1 2 10 15] 1}}
{Show {Position [1 2 10 15] 3}}
```

```
1\**-  Oz             All L5      (Oz)
```

```
'Position examples'
2
4
3
0
4
```

```
1\**-  *Oz Emulator*   All L7      (Comint:run)
```

Ejercicio 2) - Referencias externas

1. proc {P X Y} local Z in {Q Z U} end end

   Referencias externas: Q, U

2. proc {P X Y} local Z in {Q Z Y} end end

   Referencias externas: Q

3. proc {P X Y} local Z in {P Z Y} end end

   Referencias externas: ninguna

Ejercicio 3) - Ejemplo de ejecución

Programa 1

Estado inicial

Stack	**Store**	**E**

local B in
if B then
Skip
else
skip
end
end
	-	**-**

=> Ejecución de declaración de variable

Stack	**Store**	**E**

if B then
skip
else
skip
end
	b1	**B-> b1**

=> Ejecución de condicional. Como E(B) no está determinado, el programa se suspende, a la espera que b1 tome algun valor.

Programa 2

Estado inicial

Stack	**Store**	**E**

local B in
B = false
if B then
skip
else
skip
end
end
	-	**-**

=> Ejecución de declaración de variable y composición

Stack	**Store**	**E**

B = false
if B then
skip
else
skip
end
	b1	**B-> b1**

=> Ejecución de binding de variables

Stack	**Store**	**E**

if B then
skip
else
skip
end
	b1 = **false**	B-> b1

=> Ejecución de condicional, como B = false entonces se agrega en el stack la sentencia dentro del else

Stack	**Store**	**E**
skip	b1 = false	B-> b1

=> Ejecución del skip (St6), no hay cambios en el store y se quita la sentencia.

Stack	**Store**	**E**
-	b1 = false	B-> b1

No hay nada mas en el stack, entonces el programa finaliza.

Programa 3

Estado inicial

Stack	**Store**	**E**

local X Z A B P in
proc {P X Y}
Y = X+Z
end
Z=7
X=4
{P X A}
{P A B}
end
	-	**-**

=> Ejecución de declaración de variables

Stack	**Store**	**E**

proc {P X Y}
Y = X+Z
end
Z=7
X=4
{P X A}
{P A B}
	x1
	z1
	a1
	b1
	p1
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> Ejecución de procedure value

Stack	**Store**	**E**

Z=7
X=4
{P X A}
{P A B}
	x1
	z1
	a1
	b1
	p1 = **proc {P X Y}**
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Ejecución de binding de variable**

Stack	**Store**	**E**

X=4
{P X A}
{P A B}
	x1
	z1 = **7**
	a1
	b1
	p1 = proc {P X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Ejecución de binding de variable**

Stack	**Store**	**E**

{P X A}
{P A B}
	x1 = **4**
	z1 = 7
	a1
	b1
	p1 = proc {P X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Ejecución de procedure value**

Stack	**Store**	**E**

A = **X** + **Z**
{P A B}
	x1 = 4
	z1 = 7
	a1
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Asignacion de variable mas suma en base al store**

Stack	**Store**	**E**

{P A B}	x1 = 4
	z1 = 7
	a1 = **11**
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Ejecución de procedure value**

Stack	Store	E

B = A + Z	x1 = 4
	z1 = 7
	a1 = 11
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

=> **Asignacion de variable mas suma en base al store**

Stack	Store	E

-	x1 = 4
	z1 = 7
	a1 = 11
	b1 = **18**
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X -> x1
		Z-> z1
		A -> a1
		B -> b1
		P-> p1

Programa 4

Estado inicial

Stack	Store	E

local X Z A B P in
proc {P X Y}
Y = X+Z
end
Z=10
local Z in
Z = 2
X=4
{P X A}
{P A B}
end
end
	-	-

=> **Ejecución de declaración de variables**

Stack	Store	E

proc {P X Y}
Y = X+Z
end
Z=10
local Z in
Z = 2
X=4
{P X A}
{P A B}
end
	x1
	z1
	a1
	b1
	p1
		X - > x1
		Z -> z1
		A -> a1
		B -> b1
		P -> p1

=> Ejecución de declaración de procedure value

Stack	Store	E

Z=10
local Z in
Z = 2
X=4
{P X A}
{P A B}
end
	x1
	z1
	a1
	b1
	p1 = **proc {$ X Y}**
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z1
		A -> a1
		B -> b1
		P -> p1

=> Ejecución de asignación de variable

Stack	Store	E

local Z in
Z = 2
X=4
{P X A}
{P A B}
end
	x1
	z1 = **10**
	a1
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z1
		A -> a1
		B -> b1
		P -> p1

=> Ejecución de declaración de variable Z

Stack	Store	E

Z = 2
X=4
{P X A}
{P A B}
	x1
	z1 = 10
	z2
	a1
	b1
	p1 = proc {$ X Y}
		X - > x1
		Z -> **z2**
		A -> a1
		B -> b1
		P -> p1

	Y = X+Z
	end, CE = {Z -> z1}	

=> **Ejecución de asignación de variable Z (en el nuevo entorno)**

Stack	**Store**	**E**

X=4
{P X A}
{P A B}
	x1
	z1 = 10
	z2 = **2**
	a1
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

=> **Ejecución de asignación de variable X (en el nuevo entorno)**

Stack	**Store**	**E**

{P X A}
{P A B}
	x1 = **4**
	z1 = 10
	z2 = 2
	a1
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

=> **Ejecución de procedure value (en el nuevo entorno usando su entorno contextual)**

Stack	**Store**	**E**

A = X + Z
{P A B}
	x1 = 4
	z1 = 10
	z2 = 2
	a1
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

=> **Ejecución de la única sentencia del procedure (en el nuevo entorno usando su entorno contextual)**

Stack	**Store**	**E**

{P A B}	x1 = 4
	z1 = 10
	z2 = 2
	a1 = **14 (Z -> z1 = 10)**
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

=> Ejecución del procedure value(en el nuevo entorno usando su entorno contextual)

Stack	**Store**	**E**

B = A + Z	x1 = 4
	z1 = 10
	z2 = 2
	a1 = 14
	b1
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

=> Ejecución de la única sentencia del procedure (en el nuevo entorno usando su entorno contextual)

Stack	**Store**	**E**

-	x1 = 4
	z1 = 10
	z2 = 2
	a1 = 14
	b1 = **24 (a1:14 +z1:10)**
	p1 = proc {$ X Y}
	Y = X+Z
	end, CE = {Z -> z1}
		X - > x1
		Z -> z2
		A -> a1
		B -> b1
		P -> p1

Fin del programa

Programa 5

Estado inicial

Stack	**Store**	**E**

local X Y Z P Q in
        X=6
        Y=4
        proc {P A B}
                proc {B U V}
                        local F in
                                F=A+1
                                V=U+F
                        end
                end
        end
        {P X Q}
        {Q Y Z}
end
	-	**-**

=> **Declaracion de variables**

Stack	**Store**	**E**

X=6
Y=4
proc {P A B}
        proc {B U V}
                local F in
                        F=A+1
                        V=U+F
                end
        end
end
{P X Q}
{Q Y Z}
	x1
	y1
	z1
	p1
	q1
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Asignación de variable**

Stack	Store	E

Y=4
proc {P A B}
        proc {B U V}
                local F in
	x1 = **6**
	y1
	z1
	p1
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1

F=A+1
            V=U+F
        end
    end
end
{P X Q}
{Q Y Z}
	q1	Q -> q1

=> **Asignación de variable**

Stack	Store	E

proc {P A B}
    proc {B U V}
        local F in
            F=A+1
            V=U+F
        end
    end
end
{P X Q}
{Q Y Z}
	x1 = 6
	y1 = **4**
	z1
	p1
	q1
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Declaración procedure value**

Stack	Store	E

{P X Q}
{Q Y Z}
	x1 = 6
	y1 = 4
	z1
	p1 = **proc {$ A B}**
	    proc {B U V}
	        local F in
	            F=A+1
	            V=U+F
	        end
	    end
	end, CE = {}
	q1
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Ejecución procedure value**

Stack	Store	E

proc {Q U V}
local F in
F = X + 1
V = U + F
end
end
{Q Y Z}
	x1 = 6
	y1 = 4
	z1
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Declaración procedure value**

Stack	Store	E

{Q Y Z}	x1 = 6
	y1 = 4
	z1
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1 = **proc {$ U V}**
	local F in
	F = X + 1
	V = U + F
	end
	End, CE = {X-> x1}
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Ejecución procedure value**

Stack	Store	E

local F in
F = X + 1
Z = Y + F
end
	x1 = 6
	y1 = 4
	z1
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1 = proc {$ U V}
	local F in
	F = X + 1
	V = U + F
	end
	End, CE = {X-> x1}
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **declaración de variable**

Stack	Store	E

F = X + 1
Z = Y + F
	x1 = 6
	y1 = 4
	z1
	f1
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1 = proc {$ U V}
	local F in
	F = X + 1
	V = U + F
	end
	End, CE = {X-> x1, **F -> f1**}
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Asignación y suma de variables**

Stack	Store	E

Z = Y + F	x1 = 6
	y1 = 4
	z1
	f1 = **7**
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1 = proc {$ U V}
	local F in
	F = X + 1
	V = U + F
	end
	End, CE = {X-> x1, F -> f1}
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

=> **Asignación y suma de variables**

Stack	Store	E

-	x1 = 6
	y1 = 4
	z1 = **7(f1) + 4(y1) = 11**
	f1 = 7
	p1 = proc {$ A B}
	proc {B U V}
	local F in
	F=A+1
	V=U+F
	end
	end
	end, CE = {}
	q1 = proc {$ U V}
	local F in
	F = X + 1
	V = U + F
	end
	End, CE = {X-> x1, F -> f1}
		X -> x1
		Y -> y1
		Z -> z1
		P -> p1
		Q -> q1

Programa 6

Estado inicial

Stack	**Store**	**E**

local X Y Z in
X = Y
try
X = 1 Y = 2 Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
end
	-	**-**

=> **Declaración de variables**

Stack	**Store**	**E**

X = Y
try
X = 1 Y = 2 Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
	x1
	y1
	z1
		X -> x1
		Y -> y1
		Z -> z1

=> **Asignación de variables**

Stack	**Store**	**E**

try
X = 1
Y = 2
Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
	x1
	y1
	z1
		X -> y1
		Y -> y1
		Z -> z1

=> **Ejecución de try**

Stack	**Store**	**E**

X = 1
Y = 2
	x1
	y1
		X -> y1
		Y -> y1

Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
	z1	Z -> z1

=> Ejecución de asignación de variable (dentro del catch)

Stack	**Store**	**E**

Y = 2
Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
	x1
	y1 = **1**
	z1
		X -> y1
		Y -> y1
		Z -> z1

=> Ejecución de asignación de variable (dentro del catch)

Stack	**Store**	**E**

Y = 2
Z = 3
catch Exception then
skip
end
{Browse X#Y#Z}
	x1
	y1 = 1
	z1
		X -> y1
		Y -> y1
		Z -> z1

Acá se intenta asignar a y1 el valor 2, pero esta variable ya tiene valor porque X = Y, entonces dispara la Exception y se quitan todas las operaciones hasta la del catch

=> Ejecución Exception

Stack	**Store**	**E**
skip {Browse X#Y#Z}	x1 y1 = 1 z1	X -> y1 Y -> y1 Z -> z1

=> Ejecución Skip

Stack	**Store**	**E**
{Browse X#Y#Z}	x1 y1 = 1 z1	X -> y1 Y -> y1 Z -> z1

=> **Ejecución Browse**

Stack	Store	E
	x1 y1 = 1 z1	X -> y1 Y -> y1 Z -> z1

Como el valor de Z no esta determinado el browse mostrará un '_' indicando que aun no se definió, en otras operaciones podría suspenderse la ejecución, pero no ocurre con Browse. La ejecución mostrará:

1#1#_

Ejercicio 4) - Case

{Test [b c a]}

Predicción: 'case'(4)

Ejecución: 'case'(4)

La lista no empieza con a como primer elemento, ni es un record, es una lista pero el primer y elemento no son iguales, luego es una lista, entonces case 4.

{Test f(b(3))}

Predicción: 'case'(5)

Ejecución: 'case'(5)

No es lista que empiece con a, si bien es un tupla llamada f, su valor no es a sino b(3), tampoco es una lista, con lo cual saltamos al caso 5 que cumple, dado que es un tupla llamada f y Y tomará el valor b(3)

{Test f(a)}

Predicción: 'case'(2)

Ejecución: 'case'(2)

No es lista, entonces analiza el case 2 donde coincide el nombre de la tupla y el elemento que contiene.

{Test f(a(3))}

Predicción: 'case'(5)

Ejecución: 'case'(5)

No es lista, luego es una tupla llamada f pero el elemento no es a, luego caso 3 y 4 no cumple por no ser una lista, en el caso 5 satisface la condición porque se llama f y el valor de la variable Y será a(3)

{Test f(d)}

Predicción: 'case'(5)

Ejecución: 'case'(5)

No es lista, luego es una tupla llamada f pero el elemento no es a, luego caso 3 y 4 no cumple por no ser una lista, en el caso 5 satisface la condición porque se llama f y el valor de la variable Y será d

{Test [a b c]}

Predición: 'case'(1)

Ejecución: 'case'(1)

Es una lista que empieza con el valor a, cumple la primer condición.

{Test [c a b]}

Prediccion: 'case'(4)

Ejecución:'case'(4)

No es una lista que comience con el valor a, luego no es una tupla, luego no es una lista con los primeros dos elementos iguales. Finalmente es una lista por lo que entra en el caso 4.

{Test ala}

Predicción: 'case'(1)

Ejecución: 'case'(1)

Es una lista que comienza con el valor a.

{Test 'l'(v b)}

Predicción: 'case'(6)

Ejecución: 'case'(4)

No es una lista que comience con a, tampoco es tupla, no es una lista con dos elementos iguales al inicio, pero si es una lista donde el valor de Zes b. El motivo por el cual mi predicción fue incorrecta es que pensé que el formato aceptado era una cabeza con una cola, o sea que debía ser ‘l’(v [b]), pero es incorrecto.

{Test 'l'(a a)}

Predicción: 'case'(6)

Ejecución: 'case'(1)

Es una lista que comienza con a, por el mismo motivo que el punto anterior me equivoqué en la predicción.

{Test 'l'(b b)}

Predicción 'case'(6)

Ejecución: 'case'(3)

No es una lista que comienza con a, luego tampoco es tupla, luego si es una lista con ambos elementos primero y segundo iguales.

{Test 'l'(a b c)}

Predicción 'case'(6)

Ejecución: 'case'(6)

Al tener 3 elementos no coincide con una lista iniciando con a, luego no es tupla ni lista con ambos elementos iguales, tampoco es lista en la 4ta opcion, tampoco tupla llamada f, y queda como única opción el caso 6.

{Test 'l'(a [b c]}

Predicción: 'case'(1)

Ejecución: 'case'(1)

En este caso si crea con la cabeza y la cola la lista con 3 elementos que empiezan con a, por lo tanto coincide la primer condición.

Ejercicio 5) - Recursividad

1. Traducción al lenguaje Kernel

```
local Length in
   Length =  proc {$ Xs N}
            case Xs of nil then
               N = 0
            else
               case Xs of _|T then
                  local U in
                       {Length T U}
                       N = U + 1
                  end
               else
                  skip
               end
            end
           end
end
local K in
   {Length [1 2 3 4] K}
   {Show K}
end
```

2. “Tail Recursive”

```
local Length in
   Length = proc {$ Xs A N}
             case Xs of nil then
              N = A
             else
              case Xs of _|T then
                 local X in
                  X = A + 1
                  {Length T X N}

                 end
              else
                 skip
              end
             end

          end
end

local K in
   {Length [1 2 3 4] 0 K}
   {Show K}
end
```

En el primer caso no es la llamada recursiva lo último que se ejecuta, entonces voy a tener las operaciones que siguen acumuladas en el stack y hasta que no se termine la invocación de la última llamada recursiva no voy a poder liberar el stack. Al hacerlo tail recursive no tengo en el stack operaciones pendientes, el cual me queda claramente más pequeño. Este es el motivo por el cual siempre debemos tratar de hacer la invocación a la recursividad al final. Esto se verá claramente en el punto 3.

3. Ejecución en la máquina abstracta

Implementación básica

Estado inicial

Stack	**Store**	**E**

local Length in
   Length = proc {$ Xs N}
            case Xs of nil then
               N = 0
            else
               case Xs of _|T then
                  local U in
                        {Length T U}
                        N = U + 1
                  end
               else
                  skip
               end
            end
           end
end
local K in
   {Length [1 2 3 4] K}
   {Show K}
	-	-

end		

=> **Declaración de variable**

Stack	Store	E

Length = proc {$ Xs N}
      case Xs of nil then
         N = 0
      else
         case Xs of _|T then
            local U in
                  {Length T U}
                  N = U + 1
            end
         else
            skip
         end
      end
end
local K in
   {Length [1 2 3 4] K}
   {Show K}
end
	length	**length -> Length**

=> **Asignación de procedure value**

Stack	Store	E

local K in
   {Length [1 2 3 4]
K}
   {Show K}
end
	length = (**proc {$ Xs N}**
	      case Xs of nil then
	         N = 0
	      else
	         case Xs of _|T then
	            local U in
	                  {Length T U}
	                  N = U + 1
	            end
	         else
	            skip
	         end
	      end
	end, CE = {})
		length -> Length

=> **Declaración variable K**

Stack	Store	E

{Length [1 2 3 4] K}
{Show K}
	length = (proc {$ Xs N}
	      case Xs of nil then
	         N = 0
		k-> K

	else
	   case Xs of _|T then
	      local U in
	               {Length T U}
	               N = U + 1
	      end
	   else
	      skip
	   end
	end
	end, CE = {})
	k	

=> **Ejecución de procedure**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><b>case Xs of nil then</b>
                <b>N = 0</b>
<b>else</b>
      <b>case Xs of _|T then</b>
            <b>local U in</b>
                  <b>{Length T U}</b>
                  <b>N = U + 1</b>
            <b>end</b>
      <b>else</b>
            <b>skip</b>
      <b>end</b>
<b>end</b>
{Show K}</td>
<td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k
<table>
<tr><th>Store*</th><th>CE*</th></tr>
<tr><td>xs = [1 2 3 4]
n =</td><td>xs -> Xs
n -> K</td></tr>
</table>
</td>
<td>k-> K</td>
</tr>
</table>

=> **Ejecución de case**

Stack	Store	E

case Xs of _|T then
      local U in
            {Length T U}
            N = U + 1
      end
else
      skip
end
{Show K}
	length = (proc {$ Xs N}
	        case Xs of nil then
	           N = 0
	        else
	           case Xs of _|T then
	              local U in
	                        {Length T U}
	                        N = U + 1
	              end
	           else
	              skip
	           end
	        end
	end, *)
		k-> K

<table>
<tr><td></td><td>k
<table><tr><td>Store*</td><td>CE*</td></tr><tr><td>xs = [1 2 3 4]
n =</td><td>xs -> Xs
n -> K</td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td><b>local U in</b>
      <b>{Length T U}</b>
      <b>N = U + 1</b>
<b>end</b>
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k
<table><tr><td>Store*</td><td>CE*</td></tr><tr><td>xs = [1 2 3 4]
n =
<b>t = [2 3 4]</b></td><td>xs -> Xs
n -> K
t -> T</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Declaración de U**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td><b>{Length T U}</b>
<b>N = U + 1</b>
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k</td><td>k-> K</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><th>Store*</th><th>CE*</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =</td><td>n -> K
t -> T
u->U</td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>case Xs of nil then
        N = 0
     else
        case Xs of _|T then
           local U in
                 {Length T U}
                 N = U + 1
           end
        else
           skip
        end
     end
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k
<table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=</td><td>xs’ -> Xs
n’ -> N
t -> T
u->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>case Xs of _|T then
      local U in
            {Length T U}
            N = U + 1
      end
else
      skip
end</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip</td><td>k-> K</td></tr>
</table>

<table>
<tr><td>N = U + 1
{Show K}</td><td>   end
        end
end, *)
k<table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=</td><td>**xs’ -> Xs**
n’ -> N
t -> T
u->U</td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>**local U in**
        {Length T U}
        N = U + 1
end
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
            N = 0
        else
            case Xs of _|T then
                local U in
                        {Length T U}
                        N = U + 1
                end
            else
                skip
            end
        end
end, *)
k<table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]</td><td>xs’ -> Xs
n’ -> N
t’ -> T
u->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Declaración de U**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>**{Length T U}**
N = U + 1</td><td>length = (proc {$ Xs N}
        case Xs of nil then
            N = 0</td><td>k-> K</td></tr>
</table>

<table>
<tr>
<td><pre>
N = U + 1
{Show K}
</pre></td>
<td><pre>
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
</pre>
k
<table>
<tr><th>Store*</th><th>CE**</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=</td><td>xs’ -&gt; Xs
n’ -> N
t’ -> T
u’-&gt;U</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

=> Ejecución de Length

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><pre>
case Xs of nil then
         N = 0
else
   case Xs of _|T then
      local U in
            {Length T U}
            N = U + 1
      end
   else
      skip
   end
end
N = U + 1
N = U + 1
{Show K}
</pre></td>
<td>
length = (proc {$ Xs N}
<pre>
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
</pre>
k
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]</td><td>**xs” -&gt; Xs**
n” -&gt; N
t’ -> T
u’-&gt;U</td></tr>
</table>
</td>
<td>k-&gt; K</td>
</tr>
</table>

<table>
<tr><td></td><td><table><tr><td>u’=
xs’’ = **[3 4]**
n’’ =</td><td></td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>**case Xs of _|T then**
      local U in
            {Length T U}
            N = U + 1
      end
else
      skip
end
N = U + 1
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
      case Xs of nil then
         N = 0
      else
         case Xs of _|T then
            local U in
                  {Length T U}
                  N = U + 1
            end
         else
            skip
         end
      end
end, *)
k<table><tr><th>Store*</th><th>CE***</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = **[3 4]**
n’’ =</td><td>**xs’’ -> Xs**
n’’ -> N
t’ -> T
u’->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>**local U in**
      {Length T U}
      N = U + 1
end
N = U + 1
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
      case Xs of nil then
         N = 0
      else
         case Xs of _|T then
            local U in
                  {Length T U}
                  N = U + 1
            end
         else</td><td>k-> K</td></tr>
</table>

<table>
<tr>
<td></td>
<td>skip
end
end
end, *)
k
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
<b>t’’ = [4]</b></td><td>xs’’ -> Xs
n’’ -> N
<b>t’’ -> T</b>
u’->U</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Declaración de variable U**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><b>{Length T U}</b>
<b>N = U + 1</b>
N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
case Xs of nil then
N = 0
else
case Xs of _|T then
local U in
{Length T U}
N = U + 1
end
else
skip
end
end
end, *)
k
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]</td><td>xs’’ -> Xs
n’’ -> N
t’’ -> T
<b>u’’->U</b></td></tr>
</table>
</td>
<td>k-> K</td>
</tr>
</table>

<table>
<tr><td></td><td><table><tr><td>n’’ =
t’’ = [4]
<b>u’’ =</b></td><td></td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td><b>case Xs of nil then
         N = 0
else
   case Xs of _|T then
      local U in
            {Length T U}
            N = U + 1
      end
   else
      skip
   end
end</b>
N = U + 1
N = U + 1
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k<table><tr><th>Store*</th><th>CE****</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]
u’’ =
<b>xs’’’= [4]</b>
<b>n’’’=</b></td><td><b>xs’’’-> Xs</b>
<b>n’’’ -> N</b>
t’’ -> T
u’’->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td><b>case Xs of _|T then
      local U in
            {Length T U}</b></td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else</td><td>k-> K</td></tr>
</table>

<table>
<tr>
<td>   N = U + 1
      end
else
      skip
end
N = U + 1
N = U + 1
N = U + 1
{Show K}</td>
<td>   case Xs of _|T then
               local U in
                        {Length T U}
                        N = U + 1
               end
            else
               skip
            end
         end
end, *)
k
<table>
<tr><th>Store*</th><th>CE****</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]
u’’ =
xs’’’= [4]
n’’’=</td><td>xs’’’-> Xs
n’’’ -> N
t’’ -> T
u’’-&gt;U</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>local U in
      {Length T U}
      N = U + 1
end
N = U + 1
N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
         case Xs of nil then
            N = 0
         else
            case Xs of _|T then
               local U in
                        {Length T U}
                        N = U + 1
               end
            else
               skip
            end
         end
end, *)
k
<table>
<tr><th>Store*</th><th>CE****</th></tr>
<tr><td>xs = [1 2 3 4]</td><td>xs’’’-&gt; Xs</td></tr>
</table>
</td>
<td>k-&gt; K</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr>
<td>n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]
u’’ =
xs’’’= [4]
n’’’=
t’’’ = nil</td>
<td>n’’’ -> N
<b>t’’’ -> T</b>
u’’->U</td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Declaración variable U**

<table>
<tr>
<th>Stack</th>
<th>Store</th>
<th>E</th>
</tr>
<tr>
<td><b>{Length T U}</b>
<b>N = U + 1</b>
N = U + 1
N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
        case Xs of nil then
            N = 0
        else
            case Xs of _|T then
                local U in
                            {Length T U}
                            N = U + 1
                end
            else
                skip
            end
        end
end, *)
k
<table>
<tr>
<th>Store*</th>
<th>CE****</th>
</tr>
<tr>
<td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]</td>
<td>xs’’’-> Xs
n’’’ -> N
<b>t’’’ -> T</b>
<b>u’’’->U</b></td>
</tr>
</table>
</td>
<td>k-> K</td>
</tr>
</table>

<table>
<tr><td></td><td><table><tr><td>u’’ =
xs’’’= [4]
n’’’=
t’’’ = nil
u’’’ =</td><td></td></tr></table></td><td></td></tr>
</table>

=> **Ejecución Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td><b>case Xs of nil then</b>
          <b>N = 0</b>
<b>else</b>
   <b>case Xs of _|T then</b>
      <b>local U in</b>
            <b>{Length T U}</b>
            <b>N = U + 1</b>
      <b>end</b>
   <b>else</b>
      <b>skip</b>
   <b>end</b>
<b>end</b>
N = U + 1
N = U + 1
N = U + 1
N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k<table><tr><th>Store*</th><th>CE****</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]
u’’ =
xs’’’= [4]
n’’’=
t’’’ = nil
u’’’ =
<b>xs’’’’= nil</b>
<b>n’’’’=</b></td><td><b>xs’’’’-> Xs</b>
<b>n’’’’ -> N</b>
t’’’ -> T
u’’’->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Ejecución case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><b>N = 0</b>
N = U + 1
N = U + 1
N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
        case Xs of nil then
            N = 0
        else
            case Xs of _|T then
                local U in
                            {Length T U}
                            N = U + 1
                end
            else
                skip
            end
        end
end, *)
k
<table>
<tr><th>Store*</th><th>CE****</th></tr>
<tr>
<td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs’’ = [3 4]
n’’ =
t’’ = [4]
u’’ =
xs’’’= [4]
n’’’=
t’’’ = nil
u’’’ =
xs’’’’= nil
n’’’’=</td>
<td>xs’’’’-> Xs
n’’’’ -> N
t’’’ -> T
u’’’->U</td>
</tr>
</table>
</td>
<td>k-> K</td>
</tr>
</table>

=> **Ejecución asignación valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>N = U + 1
N = U + 1
N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
        case Xs of nil then
            N = 0
        else
            case Xs of _|T then
                local U in
                            {Length T U}
                            N = U + 1
                end</td>
<td>k-> K</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<pre>
            else
               skip
            end
         end
end, *)
</pre>
k
<table>
<tr><th>Store*</th><th>CE****</th></tr>
<tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs” = [3 4]
n” =
t” = [4]
u” =
xs”’= [4]
n”’=
t”’ = nil
u”’ =
xs””= nil
<b>n””= 0</b></td><td>xs””-&gt; Xs
n”” -&gt; N
t”’ -&gt; T
u”’-&gt;U</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Ejecución asignación valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>
<pre>
N = U + 1
N = U + 1
N = U + 1
{Show K}
</pre>
</td>
<td>
<pre>
length = (proc {$ Xs N}
         case Xs of nil then
            N = 0
         else
            case Xs of _|T then
               local U in
                         {Length T U}
                         N = U + 1
               end
            else
               skip
            end
         end
end, *)
</pre>
k
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr><td>xs = [1 2 3 4]</td><td>n”’ -&gt; N</td></tr>
</table>
</td>
<td>k-&gt; K</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td><table><tr><td>n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs” = [3 4]
n” =
t” = [4]
u” =
xs’”= [4]
n’”= 1
t’” = nil
u’” = 0</td><td>u’”-&gt;U</td></tr></table></td>
<td></td>
</tr>
</table>

=> Ejecución asignación valor

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>N = U + 1
N = U + 1
{Show K}</td>
<td>length = (proc {$ Xs N}
case Xs of nil then
N = 0
else
case Xs of _|T then
local U in
{Length T U}
N = U + 1
end
else
skip
end
end
end, *)
k
<table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’=
t’=[3 4]
u’=
xs” = [3 4]
n” = 2</td><td>n” -&gt; N
u”-&gt;U</td></tr></table></td>
<td>k-&gt; K</td>
</tr>
</table>

<table>
<tr><td></td><td><table><tr><td>t” = [4]
u” = 1</td><td></td></tr></table></td><td></td></tr>
</table>

=> **Ejecución asignación valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>N = U + 1
{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)
k
<table><tr><th>Store*</th><th>CE*</th></tr><tr><td>xs = [1 2 3 4]
n =
t = [2 3 4]
u =
xs’=[2 3 4]
n’= 3
t’=[3 4]
u’= 2</td><td>n’ -> N
u’->U</td></tr></table></td><td>k-> K</td></tr>
</table>

=> **Ejecución asignación valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>{Show K}</td><td>length = (proc {$ Xs N}
        case Xs of nil then
           N = 0
        else
           case Xs of _|T then
              local U in
                        {Length T U}
                        N = U + 1
              end
           else
              skip
           end
        end
end, *)</td><td>k-> K</td></tr>
</table>

<table>
<tr><td></td><td><b>k = 4</b>
<table>
<tr><td>Store*</td><td>CE</td></tr>
<tr><td>xs = [1 2 3 4]
n = 4
t = [2 3 4]
u = 3</td><td>n -> N
u->U</td></tr>
</table>
</td><td></td></tr>
</table>

=> Ejecución de show, muestra un 4

Stack	**Store**	**E**

	length = (proc {$ Xs N}
	        case Xs of nil then
	           N = 0
	        else
	           case Xs of _|T then
	              local U in
	                        {Length T U}
	                        N = U + 1
	              end
	           else
	              skip
	           end
	        end
	end, *)
	k = 4
		k-> K

Implementación Tail Recursive

Estado inicial

Stack	**Store**	**E**

local Length in
   Length = proc {$ Xs A N}
             case Xs of nil then
              N = A
             else
              case Xs of _|T then
                 local X in
                  X = A + 1
                  {Length T X N}
 	
                 end
              else
                 skip
              end
             end
	-	-

end
end
 	
local K in
{Length [1 2 3 4] 0 K}
{Show K}
end		

=> **Declaración de variable**

Stack	Store	E

Length = proc {$ Xs A N}
case Xs of nil then
N = A
else
case Xs of _|T then
local X in
X = A + 1
{Length T X N}
end
else
skip
end
end
end
 	
local K in
{Length [1 2 3 4] 0 K}
{Show K}
end
	length =	**Length ->length**

=> **Asignación procedure value**

Stack	Store	E

local K in
{Length [1 2 3 4] 0
K}
{Show K}
end
	length =**{proc {$ Xs A N}**
	case Xs of nil then
	N = A
	else
	case Xs of _|T then
	local X in
	X = A + 1
	{Length T X N}
	end
	else
	skip
	end
	end, CE={}}
		Length ->length

=> Declaración variable K

Stack	Store	E

{Length [1 2 3 4] 0 K}
{Show K}
	length ={proc {$ Xs A N}
	 case Xs of nil then
	        N = A
	 else
	        case Xs of _|T then
	                local X in
	                        X = A + 1
	                        {Length T X N}
	             end
	        else
	                skip
	        end
	 end, CE={}}
	K=
		Length ->length
		K -> k

=> Ejecución de Length

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>case Xs of nil then
        N = A
else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
<table>
<tr><th>Store*</th><th>CE</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =</td><td>Xs -> xs
A -> a
N->n
K->k</td></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> Ejecución de case

Stack	Store	E

case Xs of _|T then
        local X in
                X = A + 1
                {Length T X N}
	length ={proc {$ Xs A N}
	 case Xs of nil then
	        N = A
	 else
		Length ->length
		K -> k

<table>
<tr>
<td><pre>
     end
else
        skip
end
{Show K}
</pre></td>
<td><pre>
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
</pre>
<table>
<tr><th>Store*</th><th>CE</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =</td><td>Xs -&gt; xs
A -> a
N-&gt;n
K-&gt;k</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><pre>
local X in
        X = A + 1
        {Length T X N}
end
{Show K}
</pre></td>
<td><pre>
length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
</pre>
<table>
<tr><th>Store*</th><th>CE</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =
<b>t=[2 3 4]</b></td><td>Xs -&gt; xs
A -> a
N-&gt;n
K-&gt;k
<b>T-&gt;t</b></td></tr>
</table>
</td>
<td>Length ->length
K -&gt; k</td>
</tr>
</table>

=> **Declaración de variable local X**

Stack	**Store**	**E**

<table>
<tr>
<td><pre>X = A + 1
{Length T X N}
{Show K}</pre></td>
<td><pre>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=</pre>
<table>
<tr><th>Store*</th><th>CE</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
<b>x=</b></td><td>Xs -&gt; xs
A -> a
N->n
K-&gt;k
T-&gt;t
<b>X-&gt;x</b></td></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> **Asignación de valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td><pre>{Length T X N}
{Show K}</pre></td>
<td><pre>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=</pre>
<table>
<tr><th>Store*</th><th>CE</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]</td><td>Xs -&gt; xs
A -> a
N->n
K-&gt;k
T-&gt;t</td></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

	x=1	X->x	

=> **Ejecución de Length**

Stack	**Store**	**E**

`case Xs of nil then`
`        N = A`
`else`
`        case Xs of _|T then`
`                local X in`
`                        X = A + 1`
`                        {Length T X N}`
`             end`
`        else`
`                skip`
`        end`
` end`
`{Show K}`
	length =`{proc {$ Xs A N}`
	` case Xs of nil then`
	`        N = A`
	` else`
	`        case Xs of _|T then`
	`                local X in`
	`                        X = A + 1`
	`                        {Length T X N}`
	`             end`
	`        else`
	`                skip`
	`        end`
	` end, *}`
	K=
		Length ->length
		K -> k

Store*	CE*
xs=[1 2 3 4] a =0 n= k = t=[2 3 4] x=1 **xs'=[2 3 4]** **a'=1** **n'=**	**Xs -> xs'** **A -> a'** **N->n'** K->k T->t X->x

=> **Ejecución de case**

Stack	**Store**	**E**

`case Xs of _|T then`
`        local X in`
`                X = A + 1`
`                {Length T X N}`
`     end`
`else`
`        skip`
`end`
`Show K}`
	length =`{proc {$ Xs A N}`
	` case Xs of nil then`
	`        N = A`
	` else`
	`        case Xs of _|T then`
	`                local X in`
	`                        X = A + 1`
	`                        {Length T X N}`
	`             end`
	`        else`
	`                skip`
	`        end`
	` end, *}`
		Length ->length
		K -> k

<table>
<tr>
<td></td>
<td>K=
<table><tr><th>Store*</th><th>CE*</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=</td><td>**Xs -> xs’**
A -> a’
N->n’
K->k
T->t
X->x</td></tr></table></td>
<td></td>
</tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>local X in
        X = A + 1
        {Length T X N}
end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
<table><tr><th>Store*</th><th>CE*</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]</td><td>Xs -> xs’
A -> a’
N->n’
K->k
T->t’
X->x</td></tr></table></td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> Declaración de X

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>X = A + 1
{Length T X N}
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
              local X in
                    X = A + 1
                    {Length T X N}
           end
        else
              skip
        end
 end, *}
K=
<table>
<tr><th>Store*</th><th>CE*</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
<b>x’=</b></td><td>Xs -> xs’
A -> a’
N->n’
K->k
T->t’
<b>X->x’</b></td></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> Asignación de valor

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>{Length T X N}
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
              local X in
                    X = A + 1
                    {Length T X N}
           end
        else
              skip
        end
 end, *}
K=</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><th>Store*</th><th>CE*</th></tr>
<tr>
<td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
<b>x’= 2</b></td>
<td>Xs -> xs’
A -> a’
N->n’
K->k
T->t’
X->x’</td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Ejecución de Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>
<pre>
case Xs of nil then
        N = A
else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end
{Show K}
</pre>
</td>
<td>
<pre>
length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
</pre>
<table>
<tr><th>Store*</th><th>CE**</th></tr>
<tr>
<td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2</td>
<td><b>Xs -> xs”</b>
<b>A -> a”</b>
<b>N->n”</b>
K->k
T->t’
X->x’</td>
</tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td><table><tr><td><b>xs”=[3 4]
a”=2
n”=</b></td><td></td></tr></table></td>
<td></td>
</tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>case Xs of _|T then
        local X in
                X = A + 1
                {Length T X N}
      end
else
        skip
end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
<table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=</td><td>Xs -> xs”
A -> a”
N->n”
K->k
T->t’
X->x’</td></tr></table></td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> **Ejecución de case**

Stack	**Store**	**E**

<table>
<tr>
<td>local X in
        X = A + 1
        {Length T X N}
end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
            end
        else
                skip
        end
 end, *}
K=
<table><tr><td>Store*</td><td>CE**</td></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=
<b>t”=[4</b>]</td><td>Xs -&gt; xs”
A -&gt; a”
N-&gt;n”
K-&gt;k
<b>T-&gt;t”</b>
X-&gt;x’</td></tr></table></td>
<td>Length ->length
K -&gt; k</td>
</tr>
</table>

=> **Declaración de variable X**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>X = A + 1
{Length T X N}
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
            end
        else
                skip
        end
 end, *}
K=</td>
<td>Length ->length
K -&gt; k</td>
</tr>
</table>

<table>
<tr><td></td><td><table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=
t”=[4]
x”=</td><td>Xs -> xs”
A -> a”
N->n”
K->k
T->t”
X->x”</td></tr></table></td><td></td></tr>
</table>

=> **Asignación de valor**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>{Length T X N}
{Show K}</td><td><pre>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
               local X in
                      X = A + 1
                      {Length T X N}
             end
        else
               skip
        end
 end, *}
K=</pre><table><tr><th>Store*</th><th>CE**</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1</td><td>Xs -> xs”
A -> a”
N->n”
K->k
T->t”
X->x”</td></tr></table></td><td>Length ->length
K -> k</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
n’’=
t’’=[4]
<b>x’’= 3</b></td><td></td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>case Xs of nil then
        N = A
else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
K=
<table><tr><th>Store*</th><th>CE***</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
n’’=
t’’=[4]</td><td><b>Xs -> xs’’’</b>
<b>A -> a’’’</b>
<b>N->n’’’</b>
K->k
T->t’’
X->x’’</td></tr></table></td>
<td>Length ->length
K -> k</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td><table><tr><td>x”= 3
<b>xs’’’=[4]</b>
<b>a’’’=3</b>
<b>n’’’=</b></td><td></td></tr></table></td>
<td></td>
</tr>
</table>

=> **Ejecución de Case**

<table>
<tr>
<th>Stack</th>
<th>Store</th>
<th>E</th>
</tr>
<tr>
<td><pre>case Xs of _|T then
        local X in
                X = A + 1
                {Length T X N}
     end
else
        skip
end
{Show K}</pre></td>
<td>length =<pre>{proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}</pre>K=
<table><tr><th>Store*</th><th>CE***</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=
t”=[4]
x”= 3
xs’’’=[4]
a’’’=3
n’’’=</td><td>Xs -> xs’’’
A -> a’’’
N->n’’’
K->k
T->t”
X->x”</td></tr></table></td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> **Ejecución de Case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>local X in
        X = A + 1
        {Length T X N}
end
{Show K}</td>
<td>length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
            end
        else
                skip
        end
 end, *}
K=
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=
t”=[4]
x”= 3
xs’’’=[4]
a’’’=3
n’’’=
<b>t’’’=nil</b></td>
<td>Xs -> xs’’’
A -> a’’’
N->n’’’
K->k
<b>T->t’’’</b>
X->x’’’</td></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

=> **Declaración de variable X**

Stack	Store	E

X = A + 1
{Length T X N}
{Show K}
	length ={proc {$ Xs A N}
	 case Xs of nil then
	        N = A
		Length ->length
		K -> k

<table>
<tr>
<td></td>
<td>
<pre>
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
</pre>
K=
<table>
<tr><th>Store*</th><th>CE***</th></tr>
<tr>
<td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
n’’=
t’’=[4]
x’’= 3
xs’’’=[4]
a’’’=3
n’’’=
t’’’=nil
x’’’=</td>
<td>Xs -&gt; xs’’’
A -> a’’’
N->n’’’
K->k
T-&gt;t’’’
<b>X-&gt;x’’’</b></td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> Asignación de valor

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>{Length T X N}
{Show K}</td>
<td>
<pre>
length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
</pre>
</td>
<td>Length ->length
K -&gt; k</td>
</tr>
</table>

<table>
<tr><td></td><td>skip
end
end, *}
K=
<table><tr><th>Store*</th><th>CE***</th></tr><tr><td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
n’’=
t’’=[4]
x’’= 3
xs’’’=[4]
a’’’=3
n’’’=
t’’’=nil
<b>x’’’=4</b></td><td>Xs -> xs’’’
A -> a’’’
N->n’’’
K->k
T->t’’’
X->x’’’</td></tr></table></td><td></td></tr>
</table>

=> **Ejecución de Length**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr><td>case Xs of nil then
N = A
else
case Xs of _|T then
local X in
X = A + 1
{Length T X N}
end
else
skip
end
end
{Show K}</td><td>length ={proc {$ Xs A N}
case Xs of nil then
N = A
else
case Xs of _|T then
local X in
X = A + 1
{Length T X N}
end
else
skip
end
end, *}
K=</td><td>Length ->length
K -> k</td></tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><th>Store*</th><th>CE****</th></tr>
<tr>
<td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs”=[3 4]
a”=2
n”=
t”=[4]
x”= 3
xs’’’=[4]
a’’’=3
n’’’=
t’’’=nil
x’’’=4
<b>xs””=nil</b>
<b>a””=4</b>
<b>n””=</b></td>
<td><b>Xs -> xs””</b>
<b>A -> a””</b>
<b>N->n””</b>
K->k
T->t’’’
X->x’’’</td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Ejecución de case**

<table>
<tr><th>Stack</th><th>Store</th><th>E</th></tr>
<tr>
<td>N = A
{Show K}</td>
<td>length ={proc {$ Xs A N}
  case Xs of nil then
        N = A
  else
        case Xs of _|T then
               local X in
                      X = A + 1
                      {Length T X N}
             end
        else
               skip
        end
  end, *}
K=
<table>
<tr><th>Store*</th><th>CE****</th></tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr>
<td>xs=[1 2 3 4]
a =0
n=
k =
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
n’=
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
n’’=
t’’=[4]
x’’= 3
xs’’’=[4]
a’’’=3
n’’’=
t’’’=nil
x’’’=4
xs’’’’=nil
a’’’’=4
n’’’’=</td>
<td>Xs -> xs’’’’
A -> a’’’’
N->n’’’’
K->k
T->t’’’
X->x’’’</td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> **Asignación de valor**

<table>
<tr>
<th>Stack</th>
<th>Store</th>
<th>E</th>
</tr>
<tr>
<td>{Show K}</td>
<td>
<pre>
length ={proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}
</pre>
<b>K=4</b>
<table>
<tr>
<td>Store*</td>
<td>CE****</td>
</tr>
<tr>
<td>xs=[1 2 3 4]</td>
<td>Xs -> xs’’’’</td>
</tr>
</table>
</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr>
<td>a =0
n=
<b>k =4</b>
t=[2 3 4]
x=1
xs’=[2 3 4]
a’=1
<b>n’=4</b>
t’=[3 4]
x’= 2
xs’’=[3 4]
a’’=2
<b>n’’=4</b>
t’’=[4]
x’’= 3
xs’’’=[4]
a’’’=3
<b>n’’’=4</b>
t’’’=nil
x’’’=4
xs’’’’=nil
a’’’’=4
<b>n’’’’=4</b></td>
<td>A -> a’’’’
N->n’’’’
K->k
T->t’’’
X->x’’’</td>
</tr>
</table>
</td>
<td></td>
</tr>
</table>

=> Ejecución de show, muestra un K=4 y finaliza la ejecución

<table>
<tr>
<th>Stack</th>
<th>Store</th>
<th>E</th>
</tr>
<tr>
<td>--</td>
<td>length =<pre>{proc {$ Xs A N}
 case Xs of nil then
        N = A
 else
        case Xs of _|T then
                local X in
                        X = A + 1
                        {Length T X N}
             end
        else
                skip
        end
 end, *}</pre>K=4</td>
<td>Length ->length
K -> k</td>
</tr>
</table>

Ejercicio 6) - Alto orden con listas