

A Train Spotting in V14  
 A John Scholes - Dyalog

A  $\alpha(f\ g\ h)\omega \rightarrow (\alpha\ f\ \omega)\ g\ (\alpha\ h\ \omega)$  [fgh]  
 A  $\alpha(A\ g\ h)\omega \rightarrow A\ g\ (\alpha\ h\ \omega)$  [Agh]  
 A  $\alpha(\quad g\ h)\omega \rightarrow \quad g\ (\alpha\ h\ \omega)$  [gh]

A  $(f\ g\ h)\omega \rightarrow (\quad f\ \omega)\ g\ (\quad h\ \omega)$  [fgh]  
 A  $(A\ g\ h)\omega \rightarrow A\ g\ (\quad h\ \omega)$  [Agh]  
 A  $(\quad g\ h)\omega \rightarrow \quad g\ (\quad h\ \omega)$  [gh]

□ ← col ← ;2 2

2  
 2  
 6(÷, -)col A [fgh]  
 3 4  
 3 4  
 6(0, -)col A [Agh]  
 0 4  
 0 4  
 6( , -)col A [gh]  
 4 4  
 (÷, -)col A [fgh]  
 0.5 <sup>-2</sup>  
 0.5 <sup>-2</sup>  
 (0, -)col A [Agh]  
 0 <sup>-2</sup>  
 0 <sup>-2</sup>  
 ( , -)col A [gh]  
<sup>-2</sup> <sup>-2</sup>

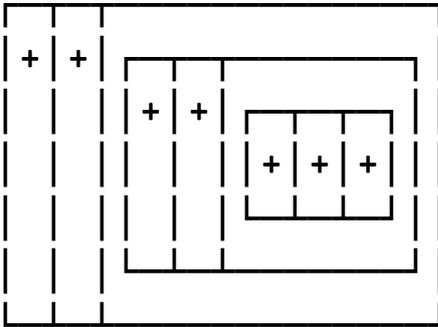
A Trains associate right:

A  $f\ g\ h\ j\ k \rightarrow f\ g\ (h\ j\ k)$   
 A  $\quad g\ h\ j\ k \rightarrow \quad g\ (h\ j\ k)$

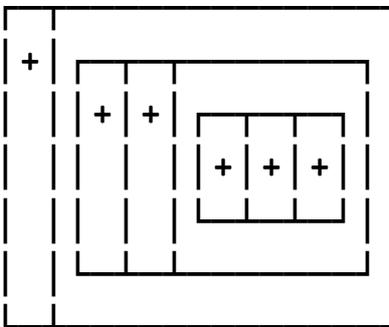
]boxing on

Was ON

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A Identities:

A  $A \circ g \ B \leftrightarrow A \ g \ B$

A left arg currying

A  $A \circ g \ h \leftrightarrow A \ g \ h$

A atop  $\leftrightarrow$  fork

A  $(f \ g)h \leftrightarrow f(g \ h)$

A 2-trains are associative

A  $(f \ g)h \leftrightarrow f \circ g \ h$

A atop  $\leftrightarrow$  composition

A Binding issues:

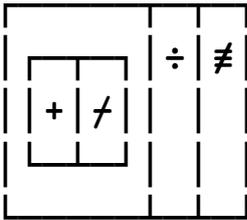
A V14 will retain classic Dyalog "early binding".

A Name replaced by its value "on encounter".

sum  $\leftarrow$  +/

avg  $\leftarrow$  sum  $\div$  # A uses value of sum

avg

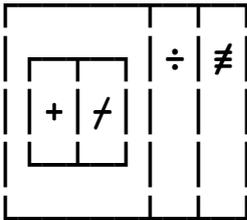


sum ← ⊗(x/\*)

A changing sum

avg

A does not change avg



A Early binding avoids this name-capture problem:

```

sum ← +
tot ← sum/
foo ← {sum ← α + ω ◊ tot sum}
1 2 3 foo 4 5 6

```

21

A Train examples:

vec ← 3 1 4 1 5 9 2 6 5

notin ← ~ε

A not-member

vec notin 1 2 3

0 0 1 0 1 1 0 1 1

minmax ← [ / , [ /

A min-max

minmax vec

1 9

fstlst ← =>, (>φ)

A first-last

fstlst vec

3 5

dice ← ?p

A dice

```

    4 dice 10
6 1 7 5
    intdiv ← [÷
    17 intdiv 5
    A int division
3
    sort ← (c4)[]
    sort vec
    A sort
1 1 2 3 4 5 5 6 9

```

A Optimised:

```

    vec
3 1 4 1 5 9 2 6 5
    vec(1 0 1 >)3
    A (vec>3)11
3
    vec(1 1 2 >)3
    A (vec>3)11
3
    vec(1 1 3 >)3
    A 1∈vec>3
1
    vec(v/ >)3
    A v/vec>3
1

```

A All of the above with: <≤=≥≠ for >  
A .. .. with: 0 for 1  
A .. .. with: +/ ^/ for v/

A And finally:

```

    1 (-+÷)×= 1
1.61803
    A Phi
    (0.5 × (-+÷)×= 2
1.41421
    A sqrt 2
    A RH
    j ← {α←0 ◊ α+0j1×ω} ◊ 3 j 4
3J4
    A KEI
    cos←2°◊ sin←1°◊

```

Euler ← \*oj = cos j sin

A RH

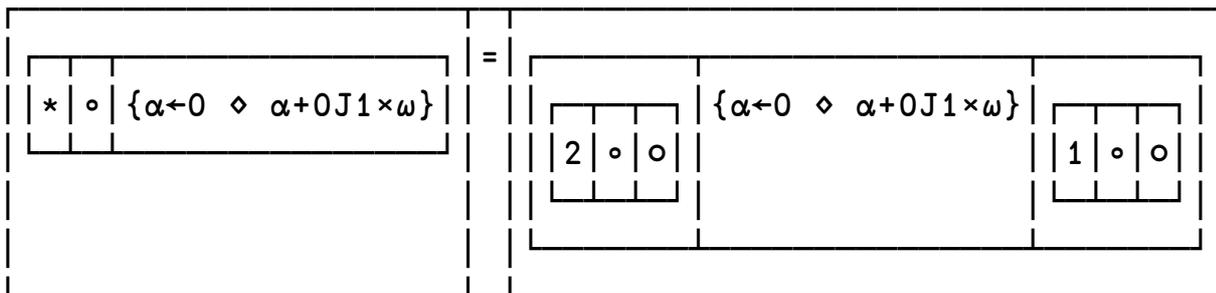
□ ← M ← 0.01 × <sup>-100</sup> + 4 5 dice 200

0.41	0.83	0.53	<sup>-</sup> 0.47	<sup>-</sup> 0.9
0.48	<sup>-</sup> 0.34	0.27	0.52	0.99
<sup>-</sup> 0.26	<sup>-</sup> 0.5	0.97	0.45	0.51
0.31	<sup>-</sup> 0.85	0.27	0.77	<sup>-</sup> 0.45

Euler M

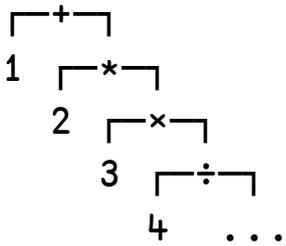
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1

Euler



A Compiling single-line dfns into trains:

parse '1+2\*3\*4÷...'



A  $\{L f R \dots\} \rightarrow (\{L\} f \{R \dots\})$  [D]

A  $\{ f R \dots\} \rightarrow ( f \{R \dots\})$  [M]

A with base cases:

A  $\{\alpha\} \rightarrow \neg$  [ $\alpha$ ]

A  $\{\omega\} \rightarrow \vdash$  [ $\omega$ ]

A and optimisations:

A  $(\{A\}g\{C\}) \rightarrow \{A g C\}$  A evaluating A g C [ $\pm$ ]

A  $(\{A\}g h) \rightarrow (A g h)$  [A]

A  $(f g\{C\}) \rightarrow (C g f)$  [C]

A  $(f(g h)) \rightarrow (f \circ g h)$  [ $\circ$ ]

A  $(f \vdash) \rightarrow f$  A for monadic f  $\vdash$  [ $\vdash$ ]

3.5  $\{(+\neq\omega) \div \neq\omega\}$  3 4 A dfn

3.5  $(\{+\neq\omega\} \div \{\neq\omega\})$  3 4 A [D]

3.5  $((+\neq\{\omega\}) \div (\neq\{\omega\}))$  3 4 A [M] [M]

3.5  $((+\neq \vdash) \div (\neq \vdash))$  3 4 A [ $\omega$ ] [ $\omega$ ]

3.5  $(+\neq \div \neq)$  3 4 A [ $\vdash$ ] [ $\vdash$ ]

3.5

A That's All Folks ...