

# Foreign ! :

This conjunction is used to communicate with the host system as well as with the keyboard (as an input file) and with the screen (as an output file). It is also used to provide a variety of extra-lingual facilities, such as setting the form of function display, determining the class of a name (noun, verb, adverb, or conjunction), and listing all existing names in specified classes.

```
(mean=: +/ % #) a=: 2 3 5 7 11 13
6.83333
```

```
mean
+/ % #
```

```
9!:3 (4)
mean
+- / --- +
--+- %
+- #
```

Tree display of verb

```
9!:3 (2 4 5)
mean
+-----+-----+
| +--+ + | % | # | | |
| + | / | | | |
| +--+ + | | | |
+-----+-----+
```

Boxed display

```
+- / --- +
--+- %
+- #
+/ % #
```

Tree display

Linear display

```
4!:0 'a' ; 'mean'
0 3
```

Classes of names (noun 0, verb 3)

```
4!:1 (3)
+-----+
| mean |
+-----+
```

List of names in class 3

The appendix shows all uses of the foreign conjunction.

## Appendix

### Foreign Conjunction

The conjunction  $! :$  applies to integer scalar left and right arguments to produce verbs, with the exception that the case  $5! : 0$  produces an adverb. These verbs behave like any other verb: they may be assigned names, may serve as arguments to adverbs and conjunctions, and must be used with an argument even though (as in  $6! : 0$  ' ') it may have no significance. Where these verbs take names as arguments, the names are boxed, as in  $4! : 55$  'a' ; 'bc' to erase the names a and bc. A bracketed left argument indicates that it is optional.

## Scripts

## 0!:

[x] 0!:k y	<p>The script <code>y</code> is executed according to the digits (zero or one) in the 3-digit decimal representation of <code>k</code>, and the resulting execution log is appended to the file named <code>x</code> (if specified):</p> <table border="0"> <thead> <tr> <th></th> <th>1st digit</th> <th>2nd digit</th> <th>3rd digit</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>From file or noun</td> <td>Stop on error</td> <td>Silent</td> </tr> <tr> <td>1</td> <td>From noun</td> <td>Continue on error</td> <td>Display</td> </tr> </tbody> </table> <p>For example, <code>0!:111 abc</code> executes the noun <code>abc</code>, completes, and displays.</p> <p>If <code>y</code> is 1, input is from the keyboard: (<code>&lt;'f2'</code>)<code>0!:1(1)</code> files the execution log in <code>f2</code>.</p> <p>Sessions begin with (silent, stop) execution of <code>0!:0&lt;'profile.ijs'</code></p>		1st digit	2nd digit	3rd digit	0	From file or noun	Stop on error	Silent	1	From noun	Continue on error	Display
	1st digit	2nd digit	3rd digit										
0	From file or noun	Stop on error	Silent										
1	From noun	Continue on error	Display										
0!:2 y	<p>The script <code>y</code> is expected to be a sequence of tautologies; <code>0!:2 y</code> is like <code>0!:1 y</code> but stops if any result is other than all 1.</p>												
0!:3 y	<p>Like <code>0!:2 y</code>, but produces a 1 or 0 result according to whether the script passes (contains only tautologies) or fails.</p>												

## Files

## 1!:

Except as otherwise noted, a file may be specified by a name (such as `<'sub\abc.q'`) or by an integer file number obtained from `open` (`1!:21 <'sub\abc.q'`).

1!:0 y	<p>Directory . y is a string of the path search expression (a boxed string is also accepted); the result is a 5-column table of the file name, modification time, size, permission, and attributes, individually boxed. For example, try <code>1!:0 '*.*'</code>. The permission and attribute columns are system dependent. For example, in Windows:</p> <pre> 1!:0 'j.exe' +-----+-----+-----+-----+  j.exe 1998 2 2 14 33 46 676864 rwx -----a  +-----+-----+-----+-----+ </pre> <p>Permission is a 3-letter string indicating the read, write, and execute permissions. Attributes is a 6-letter string indicating read-only, hidden, system, volume label, directory, and archive.</p>
1!:1 y	<p>Read . y is a file name or a file number (produced by <code>1!:21</code>); the result is a string of the file contents., e.g. <code>1!:1 &lt;'abc.q'</code>. The following values for y are also permitted:</p> <ul style="list-style-type: none"> <li>1 read from the keyboard</li> <li>3 (Unix only) read from standard input (stdin)</li> </ul>
x 1!:2 y	<p>Write . x is a string of the new contents of the file; y is a file name or file number (produced by <code>1!:21</code>). The following values for y are also permitted:</p> <ul style="list-style-type: none"> <li>2 screen output.</li> <li>4 (Unix only) standard output (stdout)</li> <li>5 (Unix only) standard error (stderr)</li> </ul>
x 1!:3 y	Append . Like <code>x 1!:2 y</code> , but appends rather than replaces
1!:4 y	Size
1!:5 y	Create Directory : y is a (boxed) directory name
[x] 1!:6 y	Query/Set Attributes
[x] 1!:7 y	Query/Set Permissions

Continued

## Files

## 1!:

Continued

1!:11 y	Indexed Read . y is a list of a boxed file name (or number) and a boxed index and length. The index may be negative. If the length is elided, the read goes to the end. For example:  1!:11 'abc.x';1000 20 f=: 1!:21 <'abc.x' 1!:11 f,1000 20
x 1!:12 y	Indexed Write . Like indexed read; x specifies the string to be written
1!:20 y	File Numbers and Names . A 2-column table of the open file numbers and names.
1!:21 y	Open . Open file named y, creating it if necessary; result is a file number.
1!:22 y	Close . Close file named or numbered y. Any locks are released.
1!:30 y	Locks . A 3-column integer table of the file number, index, and length of file locks. The argument y is required but ignored.
1!:31 y	Lock . y is a 3-element integer vector of the file number, index, and length of the file region to be locked; the result is 1 if the request succeeded, and 0 if it did not.
1!:32 y	Unlock . y is a 3-element integer vector of the file number, index, and length of the file region to be unlocked.
1!:40 y	Path . The directory path of the J application executable file.
1!:41 y	Server Path . The directory path of the JDLLServer.j.dll file (or '' if not JDLLServer).
1!:42 y	Library Path . The directory path of the directory where the J scripts are located.
1!:55 y	Erase File/Directory . e.g., 1!:55<'careful'

## Host

## 2!:

2!:0 $\gamma$	Host. The list $\gamma$ is executed by the host system, and the result is returned. For example, 2!:0 'dir *.exe'. Not available for Windows or Macintosh.
2!:1 $\gamma$	Spawn. Like 2!:0, but yields '' without waiting for the host to finish. Any output is ignored. For example, 2!:1 can be used to invoke a text-editor. Not available for Windows or Macintosh.
2!:2 $\gamma$	Host IO. (Unix only.) The host command line $\gamma$ is passed to /bin/sh for processing, connecting two file numbers to the command's standard input/output. The result is a 3-element list of the process id of the task started and the file numbers associated with its standard input and output. These file numbers also appear in the result of 1!:20. In this case, instead of appearing with a name they appear with the command line, prefixed by > (standard input) or < (standard output). The files associated with the process should be closed with 1!:22 when no longer in use. See also 2!:3 for a verb to wait for processes to complete.
2!:3 $\gamma$	Wait. (Unix only.) Wait for process id $\gamma$ to terminate. The result is the status code returned by the process.
2!:4 $\gamma$	Command Line. When J is used as a shell, the result of 2!:4 is a boxed list representing command line. The first element is the name of the shell script itself; subsequent elements are the arguments, if any.
2!:5 $\gamma$	Getenv. The value of the shell environment variable named $\gamma$ . If the named variable is undefined, the result is 0.
2!:55 $\gamma$	Terminate Session. $\gamma$ is an integer return code

## Conversions

3!:

3!:0 y	<p>Type. The internal type of the noun y, encoded as follows:</p> <ul style="list-style-type: none"> <li>1 boolean</li> <li>2 literal</li> <li>4 integer</li> <li>8 floating point</li> <li>16 complex</li> <li>32 boxed</li> <li>64 extended integer</li> <li>128 rational</li> </ul>
3!:1 y	<p>Convert to Binary Representation . A string of the binary representation of a noun y. The result is machine-dependent.</p>
3!:2 y	<p>Convert from Binary/Hex Representation . Inverse of 3!:1 and of 3!:3</p>
3!:3 y	<p>Hex Representation . Like 3!:1, but the result is a literal matrix of the hexadecimal representation. For example, under Windows:</p> <pre style="margin-left: 40px;"> (3!:3 x); 3!:3 x,lp1 [ x=: 1 2 3 0 _1 +-----+-----+  04000000 08000000   00000000 00000000   05000000 06000000   01000000 01000000   05000000 06000000   01000000 00000000   02000000 0000f03f   03000000 00000000   00000000 00000040   ffffffff 00000000              00000840              00000000              00000000              00000000              0000f0bf              182d4454              fb210940  +-----+-----+ </pre>

Continued

## Conversions

3!:

Continued

3!:4 y 3!:5 y	<p>If <math>ic=: 3!:4</math> (integer conversion) and <math>fc=: 3!:5</math> (floating conversion), then</p> <p>2 ic y      J integers to binary long integers</p> <p>_2 ic y      binary long integers to J integers</p> <p>1 ic y      J integers to binary short integers</p> <p>_1 ic y      binary short integers to J integers</p> <p>0 ic y      binary unsigned short integers to J integers</p> <p>2 fc y      J floats to binary doubles</p> <p>_2 fc y      binary doubles to J floats</p> <p>1 fc y      J floats to binary short floats</p> <p>_1 fc y      binary short floats to J floats</p> <p>All ranks are infinite and all inverses of <math>k\&amp;ic</math> and <math>k\&amp;fc</math> exist.</p>
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## Names

## 4!:

4!:0 y	Name Class . Class of (boxed) name: _2 invalid _1 unused 0 noun 1 adverb 2 conjunction 3 verb 6 locale
[x] 4!:1 y	Name List . Result is a vector of boxed names belonging to the classes 0 to 3 and 6, as defined under 4!:0 above. The optional left argument specifies the initial letters of names to be included.
4!:3 y	Scripts . List of script names that have been invoked using 0!:
4!:4 y	Script Index . Index (in 4!:3 '') of the script that defined y, or _1 if y was not defined from a script.
4!:5 y	Names Changed . 4!:5]0 turns off data collection; 4!:5]1 turns it on and produces a list of global names assigned since the last execution of 4!:5.
4!:55 y	Erase .
4!:56 y	Erase All . Erase all names and all locales.

## Representation

## 5!:

x 5!:0	Define. 5!:0 is an adverb and provides a complete inverse of 5!:1. That is, (5!:1 <'f') 5!:0 equals f for all f.
5!:1 y	<p>Atomic. The atomic representation of the entity named y and is used in gerunds. The result is a single box containing a character list of the symbol (if primitive) or a two-element boxed list of the symbol and atomic representation of the arguments (if not primitive). "Symbol-less" entities are assigned the following encodings:</p> <ul style="list-style-type: none"> <li>0 Noun</li> <li>2 Hook</li> <li>3 Fork</li> <li>4 Bonded conjunction</li> <li>5 Bident</li> <li>6 Trident</li> <li>7 Defined operator (pro-adverb or pro-conjunction)</li> </ul> <p>For example:</p> <pre> Plus=: + 5!:1 &lt;'plus' +--+  +  +--+ noun=: 3 1 4 1 5 9 5!:1 &lt;'noun' +-----+  +-----+    0 3 1 4 1 5 9    +-----+  +-----+ increment=: 1&amp;+ 5!:1 &lt;'increment' +-----+  +-----+    &amp; +-----+     +-----+ +     0 1       +-----+ +    +-----+   +-----+  +-----+ </pre>

Continued

# Representation

# 5!:

Continued

5!:2 y	<p>Boxed.</p> <pre>nub=: (i.@# = i.~) # ] 5!:2 &lt;'nub'</pre>
5!:4 y	<p>Tree . A literal matrix that represents the named entity in tree form. Thus:</p> <pre>5!:4 &lt;'nub'</pre>
5!:5 y	<p>Linear . The linear representation is a string which, when interpreted, produces the named object. For example:</p> <pre>5!:5 &lt;'nub' (i.@# = i.~) # ] 5!:5 &lt;'a' [ a=: o. i. 3 4 3.14159265358979324*i.3 4 lr=: 3 : '5!:5 &lt;'y.''' lr 10000\$x' 10000\$x'</pre>
5!:6 y	<p>Paren . Like the linear representation, but is fully parenthesized.</p> <pre>5!:6 &lt;'nub' ((i.@#) = (i.~)) # ]</pre>

For all but the noun case, the default displays established by 9!:3 provide convenient experimentation with all representations. For example, 9!:3 (6 4 2) specifies that the paren, tree, and boxed representations are all to be displayed.

## Time

6!:

6!:0 y	<p>Current . The current time in order YMDHMS (with fractional seconds):</p> <pre> 6!:0 '' 1998 3 10 23 21 14.468 </pre>
6!:1 y	Session. Seconds since start of session
[x] 6!:2 y	<p>Execute . Seconds to execute sentence y (mean of x times with default once). For example:</p> <pre> a=:?50 50\$100 6!:2 '%.a' 0.091 10 (6!:2) '%.a'      Mean time of 10 executions 0.0771 ts=: 6!:2 , 7!:2@]    Time and space ts '%.a' 0.08 369920 </pre>
6!:3 y	Delay. Delay execution for y seconds. For example, 6!:3 (2.5)

## Space

## 7!:

7!:0 y	Current . Space currently in use.
7!:1 y	Session. Total space used since start of session.
7!:2 y	Execute . Space required to execute sentence y. For example: <pre>7!:2 ',/x' [ x=: 3000 2 5\$kerygmatic' 33888</pre>
7!:3 y	Free Space . Information on the state of the J memory manager, currently a 2-column table of the block sizes and number of free blocks for each size. The definition of the result of 7!:3, as well as the availability of 7!:3 itself, are subject to change. For example: <pre>7!:3 '' 32 950 64 1135 128 554 256 157 512 74 1024 40 2048 7 4096 14 8192 1 16384 1 32768 1</pre>
7!:4 y	Release Space . Release unused memory from the J memory manager. Use of 7!:4 can have detrimental performance effects and such use is expected to be required only rarely. The definition of the effects of 7!:4, as well as the availability of 7!:4 itself, are subject to change.

See also 9!:20 and 9!:21.

## Global Parameters

9!:

9!: (2\*n) queries a parameter and (if available) 9!: (1+2\*n) sets it.

9!:0 y 9!:1 y	Random Seed . Queries and sets the random seed used in pseudo-random number generation in the verb ? (Roll • Deal). The initial value is 7^5.
9!:2 y 9!:3 y	Default Displays . The representation(s) to used for default displays of non-nouns. The representations are as defined in 5!:n: 1 atomic, 2 boxed, 4 tree, 5 linear, 6 paren.
9!:4 y 9!:5 y	Input Prompt . The initial value is ' ' (3 spaces).
9!:6 y 9!:7 y	Box-Drawing Characters . An eleven-column table whose leading row is used in default display (and in the monad format " :). Any row may be invoked by the index j in the dyad (h,v,j)":x, where h and v control the horizontal and vertical positions within the boxes. The initial settings of six rows are:  <pre> 9!:6 ' ' +++++++ -      Normal +++++++ -      7-bit ASCII                 Spaces +++++++      Normal less   -                  -      Only   - .....      Dots </pre>
9!:8 y 9!:9 y	Error Messages . e.g. replace English messages (default) by French.
9!:10 y 9!:11 y	Print Precision . The print precision in default output (initially 6). The precision in particular cases can be set using fit, thus: " :! .p

Continued

## Global Parameters

9!:

Continued	
9!:12 y	System Type . 0 PC; 1 PC386; 2 Windows; 3 Macintosh; 4 Unix; 5 OS2; 6 Windows32 (Windows95 or Windows NT); _1 Other
9!:14 y	J Version . For example: <pre> 9!:14 '' 4.01/1998-03-15/10:24 </pre>
9!:16 y 9!:17 y	Boxed Display Positioning . y is r,c specifying row and column positioning: 0 (top, left); 1 (centre); 2 (bottom, right)
9!:18 y 9!:19 y	Comparison Tolerance . Queries and sets the comparison tolerance. See Equal (=). The tolerance in particular cases can be set using fit, thus: =! . t.
9!:20 y 9!:21 y	Memory Limit . An upper bound on the size of any one memory allocation. The memory limit is initially infinity.
9!:24 y 9!:25 y	Security Level . The security level is either 0 or 1. It is initially 0, and may be set to 1 (and can not be reset to 0). When the security level is 1, executing Window driver commands and certain foreigners (!:) that can alter the external state cause a “security violation” error to be signalled. The following foreigners are prohibited: dyads 0!:n, 1!:n except 1!:40, 1!:41, and 1!:42, 2!:n, 8!:n, 14!:n, 15!:n, and 16!:n.

Window Driver

11!:

11!:0 y	Window Driver . See help files.
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## Debug

## 13!:

See Section II.J and the script `system\main\debug.ijs`.

13!:0 y	Reset. Reset stack and disable (0) or enable (1) suspension. Nearly all the facilities in the 13!: family require that suspension enabled; all the examples below assume that suspension is enabled: 13!:0 ]1
13!:1 y	Display Stack See also 13!:18.
13!:2 y	Query Stops .
13!:3 y	<p>Set Stops . Explicit stops are requested by name and line number in the argument y, which contains zero or more stop specifications separated by semicolons. Each stop specification indicates a name, line numbers (if any) for the monadic case, a colon, and line numbers (if any) for the dyadic case. An asterisk indicates “all”, and a tilde indicates “except for”. For example:</p> <pre> 13!:3 'f 0'                f monadic line 0 13!:3 'f :2'              f dyadic line 2 13!:3 'f 0 2:1'          f monadic 0 2, dyadic 1 13!:3 'f 0; g :*'        f monadic 0 and g all dyadic 13!:3 '* 0:0'            monadic 0 and dyadic 0 13!:3 'a* **;* ~ab* **;' All monadic and dyadic whose names                         begin with a, except for any beginning                         with ab        f=: 3 : 0 10 11 : 20 )       13!:3 'f 1:0'        Stop at f monad line 1, dyad line 0       f ''  stop: f        11  f[1]       13!:0 ]1            Clear stack and enable suspension       3 f 4  stop: f        20  f[:0] </pre>

Continued

## Debug

## 13!:

Continued

13!:4 y	<p>Run Again . Resume execution at the current line. For example:</p> <pre> g=: 3 : ('t=. 2*y.'; '1+t') 3 4,g 'abc'  domain error: g    t=.2      *y.  g[0]        y. abc       y.=. 25       13!:4 '' 3 4 51 </pre> <p>six-space indent indicates suspension Local value of y. Redefine local value of y. Run again</p>
13!:5 y	<p>Run Next . Resume execution at the next line. For example:</p> <pre> h=: 3 : ('t=. 2 3*y.'; '1+t') 3 4,h 5 6 7  length error: h    t=.2 3      *y.  h[0]        t=. 99        13!:5 '' 3 4 100 </pre> <p>six-space indent indicates suspension Run next</p>
13!:6 y	<p>Exit and Return . Exit the verb/adverb/conjunction at the top of the stack, returning result y . For example:</p> <pre> g=: 3 : ('t=. 2*y.'; '1+t') 3 4,g 'abc'  domain error: g    t=.2      *y.  g[0]        13!:6 [9 3 4 9       h=: 2&amp;*       3 4,h 'abc'  domain error: h  h[0]        13!:6 [97 3 4 97 </pre> <p>Exit g with result 9 Exit h with result 97</p>

Continued

# Debug

# 13!:

Continued

13!:7 y	Continue . Resume execution at line number y
[x] 13!:8 y	Signal. Signal error number {.,y (see 9!:8) with optional text x
[x] 13!:9 y	<p>Rerun . Resume execution by rerunning the verb/adverb/conjunction on the top of the stack with the specified arguments. Thus:</p> <pre> plus=: + plus/'abc'  domain error: plus  plus[:0] 13!:13 '' See below re interpretation of stack +-----+  plus 3 0 3 +   b c    +-----+ 2 (13!:9) 3 Rerun, getting another error  domain error: plus  plus[:0] 13!:13 '' Note left and right args ('a' and 5) +-----+  plus 3 0 3 +   a 5    +-----+ 1 (13!:9) 5 Rerun 6 </pre>
[x]13!:10 y	Rerun Execute . Rerun with specified executed arguments
13!:11 y	Error Number . Last error number
13!:12 y	Error Message . Last error message

Continued

# Debug

# 13!:

Continued

<p>13!:13 y</p>	<p>Stack. If suspension is enabled, 13!:13 '' produces an 8-column matrix of information on the verbs/adverbs/conjunctions on the stack:</p> <ul style="list-style-type: none"> <li>0 Name</li> <li>1 Error number or 0 if not in error</li> <li>2 Line number</li> <li>3 Name class: 3, 1, or 2, denoting verb, adverb, or conjunction</li> <li>4 Linear representation of the entity</li> <li>5 The name of the defining script</li> <li>6 Argument(s) individually boxed</li> <li>7 Locals as a 2-column matrix of name and value</li> </ul> <p>In the last two columns, nouns are included per se, and verb, adverb, and conjunction are represented by linear forms. For example:</p> <pre> mean=: sum % # sum=: plus/ plus=: 4 : 'x.+y.' mean 'abcd'  domain error: plus   x. +y.  plus[:0] </pre> <p style="text-align: center;">13!:13 '' Note tacit definitions have no locals</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="border: none;">plus</td> <td style="border: none;">3</td> <td style="border: none;">0</td> <td style="border: none;">3</td> <td style="border: none;">4</td> <td style="border: none;">:</td> <td style="border: none;">'x.+y.'</td> <td style="border: none;"> c d </td> <td style="border: none;"> x. c </td> </tr> <tr> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> <td style="border: none;"> </td> </tr> <tr> <td style="border: none;"> </td> <td style="border: none;"> 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## Debug

## 13!:

Continued

13!:14	Query Latent Expression
13!:15	Set Latent Expression. The latent expression is executed when execution is about to be suspended; error messages are suppressed; any continuation must be programmed in the latent expression.
13!:16 y	Trace . See below.
13!:17 y	Query . Is suspension enabled? (Set by 13!:0)
13!:18	Stack Text . Like 13!:1, but gives the stack as a literal matrix.
<p>The conjunction 13!:16 controls tracing.</p> <pre>u 13!:16 n (r,c) 13!:16 n</pre> <p>The right argument <i>n</i> specifies the maximum level of function call to be traced: 0 means no trace; 1 means immediate execution only; _ means trace everything; etc. The left argument can be a verb to be used for displaying arrays in the trace (and is not itself traced during tracing). It may also be integers <i>r</i>, <i>c</i>, whence the system default display is used, clipped to <i>r</i> rows and <i>c</i> columns. (Two numbers suffice as clipping parameters because the output of an <i>n</i>-dimensional array is 2-dimensional on the screen.) Finally, it may be the empty vector, whence the current trace level and display controls are shown. The result is <code>i.0 0</code>. For example:</p> <pre>trace=: 13!:16 lr   =: 3 : '5!:5&lt;'y. '''      Linear display of an array _ _ trace _                    Trace everything; display everything 9 trace 1                      Trace immediate execution only; display                                maximum of 9 rows ": trace n                    Same as _ _ trace n lr trace n                    Linear display of trace output</pre>	

Continued

## Debug

## 13!:

Continued

Tracing provides information on results within a line; the action labels, “0 monad”, “1 monad”, “9 paren”, etc., are from the parse table in Section II.E, and reflect the activities of the interpreter with high fidelity.

```

_ _ (13!:16) _
i.4
----- 0 monad -----
i.
4
0 1 2 3
=====
0 1 2 3
(i.2 4) +/ .* *: 5 * 10 20 30 40
----- 2 dyad -----
5
*
10 20 30 40
50 100 150 200
----- 0 monad -----
i.
2 4
0 1 2 3
4 5 6 7
----- 9 paren -----
0 1 2 3
4 5 6 7
----- 3 adverb -----
+
/
+/-
----- 4 conj -----
+/-
.
*
+/- .*

```

Trace everything; display everything

action  
verb  
argument  
result  
end of parse  
result of immediate exec.

left argument  
verb  
right argument  
result

verb  
argument  
result

Continued

## Debug

## 13!:

Continued

----- 1 monad -----	Words to the left of * : are parsed
* :	first because an operator may “grab”
50 100 150 200	a verb.
2500 10000 22500 40000	
----- 2 dyad -----	
0 1 2 3	left argument
4 5 6 7	
+/ .*	verb
2500 10000 22500 40000	right argument
175000 475000	result
=====	end of parse
175000 475000	result of immediate execution

## Data Driver

## 14!:

See help files and the script `system\main\dd.ijs`.

14!:0 y	Connect
14!:1 y	Disconnect
x 14!:2 y	SQL
14!:3 y	Fetch
x 14!:4 y	Columns
14!:5 y	Column Names
14!:6 y	Source Names
x 14!:7 y	Select
14!:8 y	End
14!:9 y	Error
14!:10 y	Begin Transaction
14!:11 y	Commit Transaction
14!:12 y	Rollback Transaction
14!:13 y	Table
14!:14 y	Fetch Columns
14!:15 y	Row Count

## Dynamic Link Library

## 15!:

See help files and the script `system\main\dll.ijs`.

x 15!:0 y	Call DLL Function
15!:1 y	Memory Read
x 15!:2 y	Memory Write
15!:3 y	Allocate Memory
15!:4 y	Release Memory

## Sockets

## 16!:

See help files and the script `system\main\socket.ijs`.

16!:0 y	Socket
16!:1 y	Receive
x 16!:2 y	Send
16!:3 y	Receive from
x 16!:4 y	Send to
16!:5 y	Close
16!:6 y	Connect
16!:7 y	Bind
16!:8 y	Listen
16!:9 y	Accept
16!:10 y	Select
16!:11 y	Get Options
16!:12 y	Set Options
16!:13 y	IO Control
16!:14 y	Get Host Name
16!:15 y	Get Peer Name
16!:16 y	Get Socket Name
16!:17 y	Get Host by Name
16!:18 y	Get Host by Address
16!:19 y	Get Sockets
16!:20 y	Async
16!:21 y	Clean up

## Regular Expression

## 17!:

See help files and the script `system\main\regex.ijs`.

<code>x 17!:0 y</code>	Match . Find first match
<code>x 17!:1 y</code>	Matches . Find all matches
<code>17!:2 y</code>	Compile . Compile pattern, returning handle
<code>17!:3 y</code>	Free . Release compiled pattern
<code>17!:4 y</code>	Handles . All pattern handles
<code>17!:5 y</code>	Info . Number of sub-expressions and pattern
<code>17!:6 y</code>	Error . Error text

## Locales

## 18!:

See also Section II.I and the “Locales” lab under menu item Studio|Labs... |Locales.

18!:0 y	<p>Name Class . Give the name class of the locale named y, with 0 for named, 1 for numbered, _1 for non-existent, and _2 for illegal name. Thus:</p> <pre>18!:0 ;:'base j z 45bad asdf 0' 0 0 0 _2 _1 1</pre>
[x] 18!:1 y	<p>Name List . Give the names of named (0) or numbered (1) locales. The optional left argument specifies the initial letters of names. Thus:</p> <pre>18!:1 [0          All named locales +-----+  base j jcfg jnewuser newuser z  +-----+ asdf_bb_=: 'sesquipedalian' 'jb' 18!:1 [0    All named locales beginning in j or b +-----+  base bb j jcfg jnewuser  +-----+ 18!:3 ''        Create a numbered locale +--+  0  +--+ 18!:1 i.2      All named and numbered locales +-----+  0 base j jcfg jnewuser newuser z  +-----+</pre>

Continued

## Locales

## 18!:

Continued

[x] 18!:2 y	<p>Path . The monad gives the (search) path for locale <i>y</i>; the dyad sets the path for locale <i>y</i> to <i>x</i>. The path of a locale is initially <code>,&lt;,'z'</code>, except that locale <i>z</i> has an empty path initially. If a name sought in locale <i>f</i> is not found in <i>f</i>, then it is sought in the locales in the path of <i>f</i> (but not searching their paths). For example:</p> <pre>(;:'a cd b') 18!:2 &lt;'f' 18!:2 &lt;'f'</pre> <pre>++-----+  a cd b  ++-----+</pre> <p>The path of locale <i>f</i> is set to <i>a</i>, <i>cd</i>, and <i>b</i>.</p>
18!:3 y	<p>Create . Create a previously-unused numbered locale and return its name.</p> <pre>18!:3 ''</pre> <p>Create a numbered locale</p> <pre>+++  0  +++</pre> <pre>18!:3 ''1</pre> <p>Create another one</p> <pre>+++  1  +++</pre> <pre>18!:1 [1</pre> <p>Names of numbered locales</p> <pre>+++++  0 1  +++++</pre>

Continued

## Locales

## 18!:

Continued

18!:4 y	Switch Current . Switch the current locale to y. Initially the current locale is base.
18!:5 y	Current . The name of the current locale. For example: <pre> 18!:5 '' +-----+  base  +-----+ </pre>
18!:55 y	Erase . Erase locale y (once it finishes execution). A numbered locale, once erased, may not be reused; a named locale may be reused at will.

## Numerical Functions

## 128!:

128!:0 y	<p>QR. Produces the QR decomposition of a complex matrix <code>y</code> (in the domain of matrix inverse <code>%.</code>), an Hermitian matrix and a square upper triangular matrix, individually boxed.</p> <pre> x=: +/ . *           Matrix product A=: j./?. 2 7 4\$10   A random complex matrix \$A 7 4 'Q R'=: 128!:0 A \$Q 7 4 \$R 4 4 &gt;./ , (=i.4) - (+ :Q) x Q   Q is Hermitian 6.33846e_16 0~:R                       R is upper triangular 1 1 1 1 0 1 1 1 0 0 1 1 0 0 0 1 A -: Q x R 1 </pre>
128!:1 y	R Inv. Invert square uppertriangular matrix.