

| bars make cores

|_ spec alas (map term tome)
 produces a door (a core with sample)
|% (unit term) (map term tome)
 produces a core (battery and payload)
|@ (unit term) (map term tome)
 produces a wet core (battery and payload)
|: [hoon hoon]
 produces a gate with a custom sample
|. hoon
 produces a trap (a core with one arm)
|- hoon
 produces a trap (a core with one arm) and evaluates it
|^ hoon (map term tome)
 produces a core whose battery includes a \$ arm and computes the latter
|~ [spec value]
 produces an iron gate
|* [spec value]
 produces a wet gate (a one-armed core with sample)
|= [spec value]
 produces a dry gate (a one-armed core with sample)
|? hoon
 produces a lead trap
|\$ (lest term) spec
 produces a mold

\$ bucs form molds

\$@ [spec spec]
 structure that normalizes a union tagged by head atom
\$_ hoon
 structure that normalizes to an example _foo
\$: (list spec)
 forms a cell type (tuple) [a=foo b=bar c=baz]
\$% (list spec)
 structure that recognizes a union tagged by head atom
\$< [spec spec]
 structure from filter (excluding)
\$> [spec spec]
 structure from filter (requiring)
\$| [spec hoon]
 structure with verification
\$& [spec hoon]
 repaired structure
\$^ hoon
 structure that normalizes a union tagged by head depth (cell)
\$~ [hoon spec]
 defines a custom type default value
\$- [spec spec]
 structure that normalizes to an example gate
\$= [skin spec]
 structure that wraps a face around another structure foo=bar
\$? (list spec)
 forms a type from a union of other types ?(\$foo \$bar \$baz)

\$. [spec (map term spec)]
structure as read-write core
\$; hoon
manual structure

% cens put the fun in function

%_ [wing (list (pair wing hoon))]
resolves a wing with changes, preserving type
%. [hoon hoon]
calls a gate, inverted
%^ [hoon hoon hoon hoon]
calls a gate with triple sample
%+ [hoon hoon hoon]
calls a gate with a cell sample
%- [hoon hoon]
calls a gate (fun arg)
%: [hoon (list hoon)]
calls a gate with many arguments
%~ [wing hoon hoon]
evaluates an arm in a door ~(arm core arg)
%* [wing hoon (list (pair winghoon))]
evaluates an expression, then resolves a wing with changes
%= [wing (list (pair wing hoon))]
resolves a wing with changes foo(x 1, y 2, z 3)

: cols make cells

:_ [hoon hoon]
constructs a cell, inverted
:^ [hoon hoon hoon hoon]
constructs a cell, 4-tuple [a b c d]
:+ [hoon hoon hoon]
constructs a cell, 3-tuple [a b c]
:- [hoon hoon]
constructs a cell, 2-tuple [a b], a^b (a^b^c)
:~ (list hoon)
constructs a null-terminated list ~[a b c]
:* (list hoon)
constructs an n-tuple [a b c d e ...]
:: marks a comment (digraph, not rune)

. dots nock

.+ atom
increments an atom using Nock 4 +(42)
.* [hoon hoon]
evaluates using Nock 2
.= [hoon hoon]
tests for equality using Nock 5 =(a b)
.? hoon
tests for cell or atom using Nock 3
.^ [spec hoon]
loads from namespace using Nock 12

-/= terminators terminate

-- terminates core expression (digraph, not rune)
== terminates running series of Hoon expressions (digraph, not rune)

^ kets cast
^| hoon
 converts a gold core to an iron core (invariant)
^. [hoon hoon]
 typecasts on value
^- [spec hoon]
 typecasts by explicit type label `foo`bar
^+ [hoon hoon]
 typecasts by inferred type (a fence)
^& hoon
 converts a core to a zinc core (covariant)
^~ hoon
 folds constant at compile time
^= [skin hoon]
 binds name to a value foo=bar
^? hoon
 converts a core to a lead core (bivariant)
^* spec
 bunt, produces default mold value *foo
^: spec ,foo
 produces a 'factory' gate for a type (switch from regular parsing to spec/type parsing)

~ sigs hint
~| [hoon hoon]
 prints in stack trace if failure
~\$ [term hoon]
 profiler hit counter
~_ [hoon hoon]
 prints in stack trace, user-formatted
~% [chum hoon tyre hoon]
 registers jet
~/ [chum hoon]
 registers jet with registered context
~< [\$@(term [term hoon]) hoon]
 raw hint, applied to product ("backward")
~> [\$@(term [term hoon]) hoon]
 raw hint, applied to computation ("forward")
~+ [@ hoon]
 caches a computation
~& [@ud hoon hoon]
 prints (used for debugging)
~? [@ud hoon hoon hoon]
 prints conditionally (used for debugging)
~= [hoon hoon]
 detects duplicate
~! [hoon hoon]
 prints type if compilation failure

; mics make
;; [hoon (list hoon)]
 calls a binary function as an \$n\$-ary function :(fun a b c d)
;/ hoon
 (Sail) yields tape as XML element

```

;<  [spec hoon hoon hoon]
    glues a pipeline together (monadic bind)
;~  [hoon (list hoon)]
    glues a pipeline together with a product-sample adapter (monadic bind)
;;  [spec hoon]
    normalizes with a mold, asserting fixpoint
;+
    (Sail) makes a single XML node
;*
    (Sail) makes a list of XML nodes from Hoon expression
;=  marl:hoot
    (Sail) makes a list of XML nodes


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=  tises alter
=|  [spec hoon]
    combines default type value with the subject
=.  [wing hoon hoon]
    changes one leg in the subject
=?  [wing hoon hoon hoon]
    changes one leg in the subject conditionally
=^  [skin wing hoon hoon]
    pins the head of a pair; changes a leg with the tail
=:  [(list (pair wing hoon)) hoon]
    changes multiple legs in the subject
=/  [skin hoon hoon]
    combines a named noun with the subject
;  [skin hoon hoon]
    combines a named noun with the subject, inverted
=<  [hoon hoon]
    composes two expressions, inverted
=>  [hoon hoon]
    composes two expressions
=-  [hoon hoon]
    combines a new noun with the subject
=*  [(pair term (unit spec)) hoon hoon]
    defines an alias
=,  [hoon hoon]
    exposes namespace (defines a bridge)
=+  [hoon hoon]
    combines a new noun with the subject
=~  (list hoon)
    composes many expressions


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?  wuts test
?|  (list hoon)
    logical OR (loobean)
?:  [hoon hoon hoon]
    branches on a boolean test
?.  [hoon hoon hoon]
    branches on a boolean test, inverted
?<  [hoon hoon]
    negative assertion
?>  [hoon hoon]
    positive assertion

```

?- [wing (list (pair spec hoon))]
 switches against a union, no default
 ?^ [wing hoon hoon]
 branches on whether a wing of the subject is a cell
 ?= [spec wing]
 tests pattern match
 ?# [skin wing]
 tests pattern match
 ?+ [wing hoon (list (pair spec hoon))]
 switches against a union, with default
 ?& (list hoon)
 logical AND (loobean) &(foo bar baz)
 ?@ [wing hoon hoon]
 branches on whether a wing of the subject is an atom
 ?~ [wing hoon hoon]
 branches on whether a wing of the subject is null
 ?! hoon
 logical NOT (loobean) !foo

! **zaps run wild**
 !:
 turns on stack trace
 !.
 turns off stack trace
 !, [*hoon hoon]
 emits AST of expression (use as !, *hoon expression)
 !; [hoon hoon]
 emits the type for an expression using the type of type
 !> hoon
 wraps a noun in its type
 !< hoon
 lift dynamic value into static context
 !@ [(list wing) hoon hoon]
 != hoon
 makes the Nock formula for a Hoon expression
 !? [\$@(@ { @ @}) hoon]
 restricts Hoon version
 !! ~
 crashes

/ **fases file (+ford arm of %clay)**
 /? foo
 pin a version number
 /- foo, *bar, baz=qux
 imports a file from the sur directory (* pinned with no face, = with specified face)
 /+ foo, *bar, baz=qux
 imports a file from the lib directory (* pinned with no face, = with specified face)
 /= clay-raw /sys/vane/clay
 imports results of user-specified path wrapped in face
 /% %mark
 imports mark definition from mar/
 /\$ %from %to
 imports mark conversion gate from mar/

```

/* myfile %hoon /gen/myfile/hoon
   imports the contents of a file in the desk converted to a mark (build-time static data)
+ luses arm cores
+|
   labels a chapter (produces no arm)
+$ [term spec]
   produces a structure arm (type definition)
++ [term hoon]
   produces a (normal) arm
+* [term term spec]
   produces a type constructor arm

```

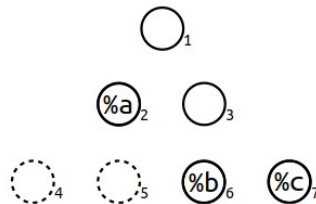
syntax

```

+1:[%a [%b %c]] [%a [%b %c]]
+2:[%a [%b %c]] %a
+3:[%a [%b %c]] [%b %c]
+4:[%a [%b %c]] %ride failed
+6:[%a [%b %c]] %b
+7:[%a [%b %c]] %c

```

[%a [%b %c]]



```

.: [%a [%b %c]] [%a [%b %c]]
-: [%a [%b %c]] %a
+: [%a [%b %c]] [%b %c]
-<: [%a [%b %c]] %ride failed
+<: [%a [%b %c]] %b
+>: [%a [%b %c]] %c

```

&n nth element

|n tail after nth element

```

<[1 2 3]> renders list as a tape
>[1 2 3]< renders list as a tank

```

. current subject

+ +:.

- -:.

+> +>:.

a.b.c limb search path

~ 0 (nil)

%y & yes/true/0

%n | no/false/1

%a constant

\$ empty term (@tas)

'urbit' cord, atom @t

"urbit" tape or list of characters

=wire shadow type name (in defn)

/path path name

% current path

lark syntax equivalents

```

+1 +5 ->
+2 - +6 +<
+3 + +7 +>
+4 -< +8 -<-

```

^face face in outer core (^^face)

..arm core in which ++arm is defined

, ,. strip the face

-: !> type spear, use as -: !> (.3.14)

eny entropy

now current time

our ship

`a [~ a]

~[a b c] [a b c ~]

[a b c]~ [[a b c] ~]

a/b [%a b]

elementary molds

* noun

@ atom (atom)

^ cell

? loobean

~ null

@p notation

@	Empty aura	
@c	Unicode codepoint	~~~45fed.
@d	Date	
@da	Date, absolute	~2020.12.25..7.15.0..1ef5
@dr	Date, relative	~d71.h19.m26.s24..9d55
@f	Loobean (for compiler, not castable)	&
@i	Internet address	
@if	IPv4 address	.195.198.143.90
@is	IPv6 address	.0.0.0.0.0.1c.c3c6.8f5a
@n	Nil (for compiler, not castable)	~
@p	Phonemic base	~laszod-dozser-fosrum-fanbyr
@q	Phonemic base, unscrambled (used with Urbit HD wallet)	~laszod-dozser-dalteb-hilsyn
@r	IEEE-754 floating-point number	
@rh	Floating-point number, half-precision, 16-bit	.~~3.14
@rs	Floating-point number, single-precision, 32-bit	.3.141592653589793
@rd	Floating-point number, double-precision, 64-bit	.~3.141592653589793
@rq	Floating-point number, quadruple-precision, 128-bit	.~~~3.141592653589793
@s	Integer, signed (sign bit low)	
@sb	Signed binary	--0b10.0000
@sd	Signed decimal	--1.000
@sv	Signed base-32	--0v201.4gvm̐.245kc
@sw	Signed base-64	--0w2.04AfS.G8xqc
@sx	Signed hexadecimal	--0x2004.90fd
@t	UTF-8 text (cord)	'urbit'
@ta	ASCII text (knot)	~.urbit
@tas	ASCII text symbol (term)	%urbit
@u	Integer, unsigned	
@ub	Unsigned binary	0b10.1011
@uc	Bitcoin address	0c1A1zP1eP5QGefi2DMPTfTL5SLmv7DivfNa
@ud	Unsigned decimal	8.675.309
@uv	Unsigned base-32	0v88nvd
@uw	Unsigned base-64	0wx5~J
@ux	Unsigned hexadecimal	0x84.5fed

Capital letters at the end of auras indicate the bitwidth in binary powers of two, starting from A.

- @ubD** signed single-byte (8-bit) decimal
- @tD** 8-bit ASCII text
- @rhE** half-precision (16-bit) floating-point number
- @uxG** unsigned 64-bit hexadecimal
- @uvJ** unsigned 512-bit integer (frequently used for entropy)

Auras are non-coercive, but conversions may have to go via the empty aura: ^-(@ud ^-(@ 'foo')).

Nock 4K

A noun is an atom or a cell. An atom is a natural number. A cell is an ordered pair of nouns.

Reduce by the first matching pattern; variables match any noun.

nock(a)	*a	
[a b c]	[a [b c]]	
[a b]	0	
?a	1	
+a	+a	
+a	1 + a	
=a a	0	
=a b	1	
/[1 a]	a	
/[2 a b]	a	
/[3 a b]	b	
/[(a + a) b]	/[2 /a b]	
/[(a + a + 1) b]	/[3 /a b]	
/a	/a	
#[1 a b]	a	
#[(a + a) b c]	#[a [b /[(a + a + 1) c]] c]	
#[(a + a + 1) b c]	#[a [/[(a + a) c] b] c]	
#a	#a	
[a [b c] d]	[[a b c] *[a d]]	
*[a 0 b]	/[b a]	slot operator (noun at tree address)
*[a 1 b]	b	constant
*[a 2 b c]	*[*[a b] *[a c]]	evaluate
[a 3 b]	?[a b]	test for atom
[a 4 b]	+[a b]	increment
[a 5 b c]	=[a b] *[a c]	distribution
*[a 6 b c d]	*[a *[c d] 0 *[2 3] 0 *[a 4 4 b]]]	if-then-else
*[a 7 b c]	*[*[a b] c]	compose
*[a 8 b c]	*[*[a b] a] c]	extend
*[a 9 b c]	*[*[a c] 2 [0 1] 0 b]	invoke
*[a 10 [b c] d]	#[b *[a c] *[a d]]	edit noun
*[a 11 [b c] d]	*[*[a c] *[a d]] 0 3]	hint
*[a 11 b c]	*[a c]	
*a	*a	interpret