

| 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
 produces a trap (a core with one arm)
|: [hoon hoon]
 produces a gate with a custom sample
|- 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
\$\$ (list spec)
 forms a cell type (tuple) [a=foo b=bar c=baz]
\$_ hoon
 structure that normalizes to an example _foo
\$\$ (list spec)
 structure that recognizes a union tagged by head atom
\$\$* hoon
 bunt (irregular form is *)
\$\$^ 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 spec]
 structure from filter (requiring)
\$\$< [spec spec]
 structure from filter (excluding)
\$\$\$\$ [spec (map term spec)]
 structure from recursion

\$| [spec hoon]
 structure with verification
\$. [spec (map term spec)]
 structure as read-write core
\$+ [stud spec]
 standard structure
\$; hoon
 manual structure
\$/ [spec (map term spec)]
 structure as write-only core
\$` [spec (map term spec)]
 structure as read-only core
\$& [spec hoon]
 repaired structure
\$! [spec (map term spec)]
 structure as opaque core

% 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)

. dotsnock

+.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	
<hr/>			
^	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	produces example type value	
^:	spec	produces a 'factory' gate for a type (switch from regular parsing to spec/type parsing)	,foo
<hr/>			
~	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	

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~!  [hoon hoon]
    prints type if compilation failure

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

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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                       foo:bar
=>  [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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-/= terminators terminate
--  terminates core expression (digraph, not rune)
==  terminates running series of Hoon expressions (digraph, not rune)

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? wuts test

? 	(list hoon) logical OR (loobean)	(foo bar baz)
?:	[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 makes the Nock formula for a Hoon expression
!?	[\$@(@ { @ @}) hoon] restricts Hoon version
!!	~ crashes
!<	hoon lift dynamic value into static context

/ fases file (+ford arm of %cLay)

/?	foo pin a version number
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/- 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
/* 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

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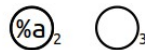
syntax

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+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]]



&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

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~ 0 (nil)
%.y & yes/true
%.n | no/false
%a constant
$ empty term (@tas)

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'urbit' cord, atom @t
"urbit" tape or list of characters
=wire shadow type name (in defn)
/path path name

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.:[%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

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 b]	+ [a b]	
+ 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