| 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)	

. 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	

^ 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	
`^&`	`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`

~ 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)`
;<	`[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	

=	**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	
=+	`[hoon hoon]`	combines a new noun with the subject	
=~	`(list hoon)`	composes many expressions	

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

? 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`)

/=	imports arbitrary Hoon file
/+	imports a file from the `lib` directory
/-	imports a file from the `sur` directory

+ luses arm cores

+|
labels a chapter (produces no arm)

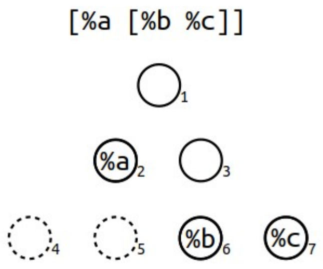
+$ `[term spec]`
produces a structure arm (type definition)

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

`&n`	*n*th element
`|n`	tail after *n*th element
`<[1 2 3]>`	renders list as a tape
`>[1 2 3]<`	renders list as a tank

lark syntax equivalents

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

`.`	current subject
`+`	`+:.`
`-`	`-:.`
`+>`	`+>:.`
`a.b.c`	limb search path

`^face`	face in outer core (`^^face`)
`..arm`	core in which `++arm` is defined
`,  ,.`	strip the face
`-:!>`	type spear, use as `-:!>(.3.14)`

	`~`	0 (nil)
`%.y`	`&`	yes/true
`%.n`	`|`	no/false
	`%a`	constant

`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]`

molds

`*`	noun
`@`	atom
`^`	cell
`?`	loobean
`~`	null

```
?=($hoon %hoon) %.y
?=($hoon %loon) %.n
```

`=wire`	shadow type name (in defn)
`/path`	path name

@p notation

`@c`	Unicode codepoints	`~-~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)	`&`
`@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	`--0v201.4gvml.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
`@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'))`.

text

Single-quoted text `'urbit'` denotes a `cord` or `@t`, which is an atom.
Double-quoted text `"urbit"` denotes a `tape`, which is a list of characters, `['u' 'r' 'b' 'i' 't' ~]`.
Use `crip` to convert `tape` to `cord`, `trip` to convert `cord` to `tape`.

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
```