Mu Runtime Reference

version *0.2.13*

type keywords and aliases

supertype	*T*
bool	`()`, `:nil` are false, otherwise true
condition	*keyword,* see **exceptions**
list	`:cons` or `()`, `:nil`
ns	`#s(:ns #(:t` *fixnum symbol*`))`
ns -designator	*ns*, `:nil`, `:unqual`

`:null`	`()`, `:nil`	
`:char`	*char*	8 bit ASCII
`:cons`	*cons, list*	list, cons, dotted pair
`:fixnum`	*fixnum, fix*	56 bit signed integer
`:float`	*float, fl*	32 bit IEEE float
`:func`	*function, fn*	function
`:keyword`	*keyword, key*	symbol
`:stream`	*stream*	file or string type
`:struct`	*struct*	see **structs**
`:symbol`	*symbol, sym*	LISP-1 symbol
`:vector`	*vector, string, str*	typed vector

`:bit :char :t`
`:byte :fixnum :float`

core

apply *fn list*	*T*	apply *fn* to *list*
compile *form*	*T*	*mu* form compiler
eq *T T'*	*bool*	*T* and *T'* identical?
eval *form*	*T*	evaluate *form*
type-of *T*	*key*	type keyword
view *for*	*vector*	vector of object
fix *fn T*	*T*	fixpoint of *fn*
gc	*bool*	garbage collection
repr *T*	*vector*	tag representation
unrepr *vector*	*T*	tag representation

special forms

`:lambda` *list . list'*	*function*	anonymous *fn*
`:alambda` *list . list'*	*function*	anonymous *fn*
`:quote` *T*	*list*	quoted form
`:if` *T T' T"*	*T*	*conditional*

vector is an 8 element :`byte` vector of little-endian argument tag bits.

frames

frame binding: `(`*fn* `. #(:t …))`

%frame-stack	*list*	active *frames*
%frame-pop *fn*	*frame*	pop *function's* top frame binding
%frame-push *frame*	*cons*	push frame
%frame-ref *fn fix*	*T*	*function*, offset

symbols

boundp *sym*	*bool*	is *symbol* bound?
make-symbol *string*	*sym*	uninterned *symbol*
symbol-namespace *sym*	*ns-designator* *namespace designator*	
symbol-name *symbol*	*string*	*name binding*
symbol-value *symbol*	*T*	value binding

fixnums

add *fix fix'*	*fixnum*	sum
ash *fix fix'*	*fixnum*	arithmetic shift
div *fix fix'*	*fixnum*	quotient
less-than *fix fix'*	*bool*	*fix < fix'?*
logand *fix fix'*	*fixnum*	bitwise and
lognot *fix*	*fixnum*	bitwise complement
logor *fix fix'*	*fixnum*	bitwise or
mul *fix fix'*	*fixnum*	product
sub *fix fix'*	*fixnum*	difference

floats

fadd *fl fl'*	*float*	sum
fdiv *fl fl'*	*float*	quotient
fless-than *fl fl'*	*bool*	*fl < fl'?*
fmul *fl fl'*	*float*	product
fsub *fl fl'*	*float*	difference

conses/lists

append *list*	*list*	append lists
car *list*	*T*	head of *list*
cdr *list*	*T*	tail of *list*
cons *T T'*	*cons*	(*T* . *T'*)
length *list*	*fixnum*	length of *list*
nth *fix list*	*T*	*n*th *car* of *list*
nthcdr *fix list*	*T*	*n*th *cdr* of *list*

vectors

make-vector *key list*	*vector*	specialized *vector* from list
vector-length *vector*	*fixnum*	length of *vector*
vector-type *vector*	*key*	type of *vector*
svref *vector fix*	*T*	*n*th element

namespaces

runtime namespaces: mu (static), keyword

make-namespace *str*	*ns*	make *namespace*
namespace-name *ns*	*string*	*namespace* name
intern *ns str value*	*symbol*	intern symbol in non-static *namespace*
find-namespace *str*	*ns*	map *string* to *namespace*
find *ns string*	*symbol*	map *string* to *symbol*

structs

make-struct *key list*	*struct*	type *key* from *list*
struct-type *struct*	*key*	*struct* type *key*
struct-vec *struct*	*vector*	of *struct* members

streams

****standard-input****	*stream*	std input *stream*
****standard-output****	*stream*	std out *stream*
****error-output****	*stream*	std error *stream*
open *`type dir`* *str bool*	*stream*	open *stream,* raise error if *bool*

```
type    :file  :string
dir     :input :output :bidir
```

close *stream*	*bool*	close *stream*
openp *stream*	*bool*	is *stream* open?
flush *stream*	*bool*	flush *steam*
get-string *stream*	*string*	from *string stream*
read-byte *stream bool T*	*byte*	read *byte* from *stream,* error on eof, *T:* eof-value
read-char *stream bool T*	*char*	read *char* from *stream,* error on `eof`, *T:* `eof`-value
unread-char *char stream*	*char*	push *char* onto *stream*
write-byte *byte stream*	*byte*	write *byte*
write-char *char stream*	*char*	write *char*
read *stream bool T*	*T*	read *stream*
write T *bool stream*	*T*	write with escape

exceptions

with-exception *fn fn'*	*T*	catch exception

fn - (`:lambda` (*obj cond src*) . *body*)
fn' - (`:lambda` () . *body*)

raise *T keyword*	raise exception on *T* with *keyword* condition
raise-from *T symbol keyword*	raise exception on *T* with *keyword* condition

```
:arity   :div0    :eof     :error   :except
:future  :ns      :open    :over    :quasi
:range   :read    :exit    :signal  :stream
:syntax  :syscall :type    :unbound :under
:write   :storage :user
```

Features

```
[dependencies]
default = [ “core”, “env”, "system" ]
```

feature/core	***core***	*list*	core state
	delay	*fixnum*	microseonds
	process-mem-virt	*fixnum*	vmem
	process-mem-res	*fixnum*	reserve
	process-time	*fixnum*	microseconds
	time-units-per-sec	*fixnum*	
	ns-symbols *ns*|`:nil`	*list*	*symbol* list
feature/env	***env***	*list*	env state
	heap-info	*()*	heap info to stdout
	heap-room *key*	*vector*	allocations
	#(:t size total free …)		
	heap-size *key*	*fixnum*	type size
	cache-room	*vector*	allocations
	#(:t size total …)		
***feature*/system**	***uname***	`:t`	system info
	shell *string list*	*fixnum*	shell command
	exit *fixnum*		
	sysinfo	`:t`	not on macOS
feature/instrument	***instrument-control*** *key*	*key* | *vec*	`:on|:off|:get`

environment

```
JSON config format:

{
    “pages”: N,
    “gc-mode”: “none” | “auto”,
}
```

Mu library API

```
[dependencies]
mu = {
  git = “https://github.com/Software-Knife-and-Tool/mu.git”,
  branch = “main”
}

use mu::{ Condition, Core, Env, Exception,
          Mu, Result, Tag };

impl Mu {
  fn apply(_: &Env, _: Tag, _: Tag) → Result<Tag>
  fn compile(_: &Env, _: Tag) → Result<Tag>
  fn config(_: Option<String>) → Option<Config>
  fn core() → &Core
  fn eq(_: Tag, _: Tag) → bool;
  fn err_out() → Tag
  fn eval_str(_: &Env, _: &str) → Result<Tag>
  fn eval(_: &Env, _: Tag) → Result<Tag>
  fn exception_string(_: &Env, _: Exception) → String
  fn lo8 ptad(_: &Env, _: &str) → Result<bool>
  fn make_env(_: &Config) → Env
  fn read_str(_: &Env, _: &str) → Result<Tag>
  fn read(_: &Env, _: Tag, _: bool, _: Tag) → Result<Tag>
  fn std_in() → Tag
  fn std_out() → Tag
  fn version() → &str
  fn write_str(_: &Env, _: &str, _: Tag) → Result<()>
  fn write_to_string(_: &Env, _: Tag, _: bool) → String
  fn write(_: &Env, _: Tag, _: bool, _: Tag) → Result<()>
}
```

Reader Syntax

`;`	comment to end of line
`#|...|#`	block comment
'*form*	quoted form
`` ` ``*form*	backquoted form
`` `(…) ``	backquoted list (proper lists)
,*form*	eval backquoted form
,@*form*	eval-splice backquoted form
(…)	constant *list*
()	empty *list*, prints as `:nil`
(… . .)	dotted *list*
“…”	*string, char* vector
\	single escape in strings
ns:name	qualified *symbol,* where *ns* and *name* are *symbol constituents*
name	lexical *symbol*
#*	bit vector
#x	hexadecimal *fixnum*
#.	read-time eval
#\	*char*
#(:type …)	*vector*
#s(:type …)	*struct*
#:…	uninterned *symbol*
“ ` , ;	terminating macro char
#	non-terminating macro char
`!$%&*+-.` `<>=?@[]|` `:^_{}~/` `A..Za..z` `0..9`	*symbol constituent*
	character designators

```
0x09 #\tab
0x0a #\linefeed
0x0c #\page
0x0d #\return
0x20 #\space
```