



Mojo traits cheat sheet

What each standard library trait does, when you need it, and where it bites.

v1.1.0dev

LIFECYCLE

AnyType the root; every type conforms automatically

traits/anytype.mojo

no requirements

Deinitable has an implicit destructor, called at last use

traits/deinitable.mojo

__deinit__(deinit self, /) provided

comptime __del__is_trivial: Bool compile-time flag

Automatically added to every eligible type (all fields are also **Deinitable**). When the type is trivial, Mojo skips the destructor.

Movable transfer ownership; enables the ^ operator

traits/movable.mojo

__init__(out self, *, deinit move: Self) provided

comptime __move_ctor_is_trivial: Bool compile-time flag

Required to store a type in **List**, **Optional**, or **Variant**, or to return it by move.

Copyable explicit copy

traits/copyable.mojo

Refines: Movable

__init__(out self, *, copy: Self) provided

copy(self) -> Self provided

comptime __copy_ctor_is_trivial: Bool compile-time flag

The copy constructor is synthesized if all fields are **Copyable**.

ImplicitlyCopyable (MARKER) lets copies be inserted implicitly

traits/copyable.mojo

Refines: Copyable < Movable · no new requirements

Can mask logical errors and hide code reasoning. Prefer **Movable** or **Copyable**.

Defaultable create with no arguments

builtin/value.mojo

__init__(out self)

Reach for this when you need parameterized default-construction without arguments.

RegisterPassable

(MARKER) stored in registers, not memory; no stable address or identity

builtin/value.mojo

Refines: Movable · no requirements (marker)

No stable address: you can't take the address of **self** in imm-convention methods. **Identifiable** is meaningless for these types.

Moved trivially; all fields must also conform.

TrivialRegisterPassable

(MARKER) register-passable, copyable by moving bits, no side effects

builtin/value.mojo

Refines: ImplicitlyCopyable < Copyable < Movable, Deinitable, RegisterPassable · no requirements (marker)

A type whose values are treated as basic bit patterns. No constructors or destructors needed. All fields must also conform.

FORMAT

Writable

format itself as text; works with print(), String(), format strings

format/__init__.mojo

write_to(self, mut writer: Some[Writer]) provided

write_repr_to(self, mut writer: Some[Writer]) provided

If all fields conform, you inherit both methods through reflection.

Writer a destination for a custom output target

format/__init__.mojo

String, FileHandle, FileDescriptor conform

write_string(mut self, string: StringSpan)

write[*Ts: Writable](mut self, *args: *Ts) provided

Use for loggers, network streams, string builders, etc.

TESTING

Strategy produces random inputs for property-based tests

testing/prop/strategy/__init__.mojo

Refines: Deinitable, Movable

Value: Copyable & Deinitable associated type

value(mut self, mut rng: Rng) raises -> Self.Value

Allows strategies to carry and advance state between draws. **value()** draws one sample from the random number generator.

ACCELERATOR TRAITS

DevicePassable marks a type as passable to an accelerator

builtin/device_passable.mojo

comptime device_type: AnyType the on-device type

_to_device_type(self, mut enc, ...) DeviceContext hook

A host type implements this so it can be handed to a GPU or other accelerator. **DeviceContext** calls the conversion hook to turn host into device at kernel launch.

DeviceTypeEncoder

encodes host values into device layout

builtin/device_passable.mojo

target() -> _TargetType	device target
encode_device_ptr(mut self, ...)	required
encode[T](mut self, value, dst)	provided (+ fields, tuple, array)

Encodes a value's fields into the accelerator's data layout.

COMPARE & HASH

Equatable

equality; enables == and !=

builtin/comparable.mojo

__eq__(self, other: Self) -> Bool	provided
__ne__(self, other: Self) -> Bool	provided

Don't use with floating-point values (use **isclose()**). **NaN != NaN**.
Mojo provides a fieldwise default. Override for caches, internal metadata, and custom behavior.

Comparable

ordered comparison; < > ≤ ≥, and sort()

builtin/comparable.mojo

Refines: Equatable

__lt__(self, rhs: Self) -> Bool	
__gt__(self, rhs: Self) -> Bool	provided
__le__(self, rhs: Self) -> Bool	provided
__ge__(self, rhs: Self) -> Bool	provided

Implement **__lt__()** unless it's expensive. If so, override all four.

Hashable

produces a hash; needed for Dict keys and Set elements

hashlib/hash.mojo

KeyElement = Hashable + Equatable + Movable

__hash__(self, mut hasher: Some[Hasher])	provided
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Hasher

implements a hash algorithm (the algorithm, not a hashable type)

hashlib/hasheer.mojo

__init__(out self)	
_update_with_bytes(mut self, data: Span[Byte, _])	
_update_with_simd(mut self, value: SIMD[_,_])	
update(mut self, value: Some[Hashable])	
finish(var self) -> UInt64	

Hashers remain alive after finalization. All three update methods are required.

Identifiable

identity; same-object test, enables is / is not

builtin/identifiable.mojo

__is__(self, rhs: Self) -> Bool	
__isnot__(self, rhs: Self) -> Bool	provided

Excludes register-passable types, which don't have stable addresses.

CONVERT

Boolable, Intable, Floatable

convert with Bool(), Int(), Float64()

builtin/bool.mojo · builtin/int.mojo · builtin/floatable.mojo

__bool__(self) -> Bool	Boolable
__int__(self) -> Int	Intable
__int__(self) raises -> Int	IntableRaising
__float__(self) -> Float64	Floatable
__float__(self) raises -> Float64	FloatableRaising

If the method raises, use the Raising variant.
Boolable unlocks if / while / and / or usage.

MATH

Absable, Powable, Roundable

unary math operators

math/math.mojo

__abs__(self) -> Self	Absable · abs()
__pow__(self, exp: Self) -> Self	Powable · pow(), **
__round__(self) -> Self	Roundable · round()
__round__(self, ndigits: Int) -> Self	Roundable · round(), precision

Ceailable, Floorable, Truncable

round toward a bound

math/math.mojo

__ceil__(self) -> Self	Ceailable · ceil()
__floor__(self) -> Self	Floorable · floor()
__trunc__(self) -> Self	Truncable · trunc()

CeilDivable, CeilDivableRaising

ceiling division (rounds up instead of down)

math/math.mojo

__ceildiv__(self, denominator: Self) -> Self	CeilDivable
__ceildiv__(self, denominator: Self) raises -> Self	CeilDivableRaising

DivModable

combined division and modulo; enables divmod()

math/math.mojo

Refines: ImplicitlyCopyable < Copyable < Movable

__divmod__(self, denominator: Self) -> Tuple[Self, Self]	
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Math outlier. The tuple is (quotient, remainder).

ITERATE

Sized, SizedRaising

has a length; enables len()

builtin/len.mojo

__len__(self) -> Int	Sized
__len__(self) raises -> Int	SizedRaising

Iterable

iterate by borrowing

iter/__init__.mojo

IteratorType[iterable_mut: Bool, //,
iterable_origin: Origin[mut=iterable_mut]]:
Iterator

associated
type

__iter__(ref self) ->
Self.IteratorType[origin_of(self)]

Parameterized on mutability and origin. Yields references tied to the source lifetime.

IterableOwned

iterate by consuming and owning

iter/__init__.mojo

IteratorOwnedType: Iterator

associated type

__iter__(var self) -> Self.IteratorOwnedType

No origin tracking.

Iterator

produces elements one at a time; the for-loop workhorse

iter/__init__.mojo

Refines: Deinitable, Movable

Element: Movable

associated
type

__next__(mut self) raises StopIteration ->
Self.Element

bounds(self) -> Tuple[Int, Optional[Int]]

provided

nth(var self, n: Int) ->
Optional[Self.Element]

provided

Requires an **Iterable** on the collection, and **Iterator** on the iterator. Don't rely on **bounds()** for safety checks. It's a hint. Typed raises (**StopIteration**).

INTEROP

PathLike

represents a file system path

os/pathlike.mojo

Path conforms

__fspath__(self) -> String

ConvertibleToPython

can be sent to Python

python/conversions.mojo

Refines: Deinitable

to_python_object(var self) raises -> PyObject

ConvertibleFromPython

can be created from a Python object

python/conversions.mojo

Refines: Copyable < Movable, Deinitable

__init__(out self, *, py: PyObject) raises