# Crystal Compiled, Ruby-like language

**START HERE**

`crystal run <file.cr>`
Compile and run

`crystal build --release <file.cr>`
Optimized binary

`crystal eval '<code>'`
Run a snippet

`crystal spec`
Run the test suite

`crystal init app <name>`
Scaffold a project

`crystal tool format`
Format source files

`shards install`
Install dependencies

`crystal docs`
Generate API docs

## CONCEPTS

Crystal is compiled (via LLVM) with Ruby-like syntax and static types that are mostly inferred. There is no interpreter: run compiles to a cached temp binary each time.

**Write** src/app.cr
↓ `shards install`
**Deps** lib/ + shard.lock
↓ `crystal build`
**Build** bin/app
↓ `crystal spec`
**Test** spec/*_spec.cr

Plain build is fast but unoptimized (-O0). Benchmark and ship with --release; it is much slower to compile.

--release implies -O3 and a single-module build; use -O1 or -O2 for a middle ground when compile time hurts.

## RUN AND BUILD

`crystal run <file.cr>`
Compile and run a file

`crystal run <file.cr> -- <args>`
Pass arguments to the program
*Everything after -- goes to your program, not the compiler.*

`crystal <file.cr>`
Shorthand for run

`crystal build <file.cr>`
Build a binary in the current dir

`crystal build --release <file.cr>`
Optimized build (-O3, single module)

`crystal build -o <path> <file.cr>`
Choose the output path

`crystal build --no-debug <file.cr>`
Omit debug symbols

`crystal build --static <file.cr>`
Link statically
*Works best on Alpine/musl; glibc static linking is limited.*

`crystal build -O<level> <file.cr>`
Set optimization level 0-3, s, z

`crystal build -D <flag> <file.cr>`
Define a compile-time flag

`crystal build --cross-compile <file.cr>`
Emit .o and print the link command

## EVAL AND PLAYGROUND

`crystal eval '<code>'`
Compile and run a code string

`echo '<code>' | crystal eval`
Read code from stdin

`crystal eval --release '<code>'`
Optimized eval

`crystal play`
Start the browser playground

`crystal play --port <port> --binding <host>`
Set the playground address

`crystal version`
Print Crystal, LLVM and target triple

`crystal env [<var>]`
Print compiler environment variables

`crystal clear_cache`
Clear the compiler cache

## PROJECTS

`crystal init app <name>`
Scaffold an application

`crystal init lib <name>`
Scaffold a library

init creates src/, spec/ and shard.yml. Commit shard.lock for applications, leave it out for libraries.

`shards init`
Create a shard.yml

## SPECS

`crystal spec`
Run all specs in spec/

`crystal spec <file>`
Run one spec file

`crystal spec <file>:<line>`
Run the example at a line

`crystal spec -e '<name>'`
Run examples matching a name

`crystal spec --tag <tag>`
Run examples with a tag
*Prefix the tag with ~ to exclude it.*

`crystal spec --fail-fast`
Stop at the first failure

`crystal spec --order random`
Randomize example order

`crystal spec --profile`
Show the 10 slowest examples

`crystal spec -v`
Verbose, one line per example

Options after -- go to the spec runner; compiler flags such as --release go before the file list.

## FORMAT AND TOOLS

`crystal tool format`
Format all files in place

`crystal tool format <path>`
Format a file or folder

`crystal tool format --check`
Fail if anything is unformatted (CI)

`crystal tool unreachable <file.cr>`
List methods that are never called

`crystal tool unreachable --check`
Exit nonzero if dead code exists

`crystal tool dependencies <file.cr>`
Show the file require graph

`crystal tool expand / context / types`
Macro expansion and type inspection

`crystal docs`
Generate API docs into ./docs

## SHARDS

`shards install`
Install deps into lib/ per the lock

`shards update`
Re-resolve all deps, rewrite shard.lock

`shards build`
Install deps, build into bin/

`shards build <target>`
Build one named target

`shards list`
Show installed versions

`shards check`
Exit 1 if deps are missing

`shards prune`
Remove unused deps from lib/

`shards install --production`
Locked only, no dev deps, fail if out of sync

### shard.yml

```
name: myapp
version: 0.1.0
targets:
  myapp:
    main: src/myapp.cr
dependencies:
  kemal:
    github: kemalcr/kemal
    version: ~> 1.6
development_dependencies:
  ameba:
    github: crystal-ameba/ameba
```

Add a dependency to shard.yml by hand, then run shards install; there is no shards add command. Then require it by shard name.

## LANGUAGE BASICS

### Types and methods

```
name = "Ada"
age : Int32 = 36
def greet(who : String) :
String
  "Hi, #{who}"
end
puts greet(name)
```

### Classes and structs

```
class User
  property name : String
  getter id : Int32
  def initialize(@name, @id);
end
end
struct Point
  getter x : Int32, y : Int32
  def initialize(@x, @y); end
end
```

### Blocks and collections

```
[1, 2, 3].map { |n| n * 2 }
h = {"a" => 1}
h.each do |k, v|
  puts "#{k}=#{v}"
end
def twice
  yield
  yield
end
```

### Nil safety

```
# x is String?
x = ENV["HOME"]?
if x
  puts x.size
end
x.try &.size
x.not_nil!
```

`require "./file" / require "json"`
Load a relative file or stdlib module

`puts / p / pp`
Print, inspect, pretty inspect

Type? means Type | Nil. The compiler rejects calls on a possible nil; narrow with if, try, or not_nil! (raises at runtime).

Structs are value types and are copied on assignment; classes are heap references.

## RECIPES

### Start a new app

```
crystal init app hello
cd hello
crystal run src/hello.cr
crystal spec
```

### CI gate

```
shards install --production
crystal tool format --check
crystal spec --fail-fast
shards build --release
```

### Ship a static binary

```
crystal build --release --
static --no-debug \
  -o bin/app src/app.cr
```

### Run one failing spec

```
crystal spec spec/
user_spec.cr:12
crystal spec -e 'rejects blank
name' --fail-fast
```