

# Build Systems, Libraries, and Compiling Multiple Files

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# Objectives

- make programs outside Jupyter playground
  - SSH (command line)
  - editors, not web browsers
- build system
- use libraries
- split a program into multiple files ( $\approx$  use something defined in another file)

# Build system

many languages have “build system” to help you use external libraries

- Go: `go` is it
- Julia: no particular build system
- OCaml: `dune` <https://dune.build/>
- Rust: `cargo`

# Using libraries

using a library entails different procedures depending on how “embedded” it is into the language

- some libraries are **“builtin”**
  - automatically available in every program
- some libraries are **“standard”**
  - you need to master how to refer to names in it
  - you “import” (or “use”) the library and/or use prefixes to refer to names in it
  - installed with the language, so you don’t need to install it

# Using libraries

- some libraries are **“external”**
  - ▶ you may have to install it
  - ▶ you may have to tell the compiler where it is
- the unit of installing and importing a library is called differently among languages
  - ▶ Go : package
  - ▶ Julia : module
  - ▶ OCaml : module
  - ▶ Rust : crate

# Importing a library to your program

- assume  $M$  is a library name and  $n$  a name defined in  $M$
- Go:
  - ▶ `import "M"` and call  $M.n$
- OCaml:
  - ▶ call  $M.n$
  - ▶ `open M` and call  $n$

# Importing a library to your program

- Julia:
  - ▶ `import  $M$`  and call  `$M.n$`
  - ▶ `using  $M$`  and call  `$n$`
- Rust:
  - ▶ assume  $C$  is the name of a crate
  - ▶ a crate may contain nested modules ( $C \ni M_0 \ni \dots \ni n$ )
  - ▶ call  `$C::M_0::M_1::\dots::n$`
  - ▶ `use  $C::M_0::M_1::\dots::n$`  and call  `$n$`
  - ▶ anywhere between the two

# Repository of libraries

- master how to get information you need (names of functions, their types, etc.) from those repositories
- is it builtin? standard? external?
- OCaml: opam <https://opam.ocaml.org/>
- Julia: Julia packages <https://julialang.org/packages/>
- Go: <https://pkg.go.dev/>
- Rust: <https://crates.io/>