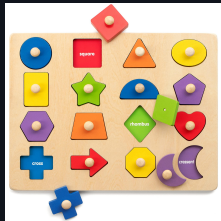


■ Data types

Mitsiu Alejandro Carreño Sarabia



Agenda

- Recap
- Types
- Instalation

■ Recap

Recap

- What is an expression?
- What is a value?
- What does this simbol means?



- Values are expressions?
- Expressions are values?
- What is imperative programming?
- What is state in computer science?

Homework

1. Bring your computer next session

2. Master your terminal:

- Change to a specific directory
- Go to parent directory
- Print current directory

3. Master your code editor:

- Search in a single file
- Search in multiple files
- Know filename and file path of open file
- Go to definition
- Split screen
- Go to a specific line in a file
- Find and replace in a single/multiple files

Homework

4. Master your keyword

- How to keypress `() [] {}`
- <https://monkeytype.com/>
- Practice PascalCase with shift key

■ Functional programming

Functional programming allows reasoning about programs and their subcomponents in the same way that you would reason about a mathematical expression.

We're not just in the business of writing code, but correct code!



Types

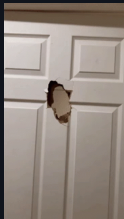
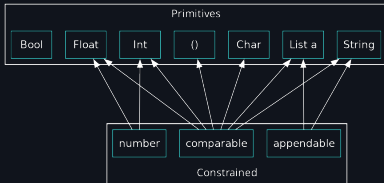
Types guide structure (shape)

Functional programming places a great emphasis on types, which serve the purpose of documenting the purpose of code, and restricting the range of behaviors that a program is allowed to exhibit.

In this way, **types guide the structure of a program**, by providing clean interfaces for how different parts should interact, and what it should be allowed to do.

Data types

We will be using a functional programming language called **Elm** which support the following data types:



Data types

Type: Is a specification of the behavior of a piece of code. It **predicts** what a program is allowed to do.

To say that an expression e has type t we write:

$$e : t$$

For example:

$$(5 + 2) * 3 : \textit{number}$$

We are communicating that the expression $(5 + 2) * 3$ must produce a value of type number (either Int or Float)

Data types

Tracing back our value definition:

Value: The result of a calculation (a **final answer** that cannot be simplified further)

We can exemplify **values** for each data type:

True : Bool

1 : Int

3.14 : Float

'a' : Char

"abc" : String

Data types & operators

Elm is a **statically typed** language, meaning that all typing rules are applied **before the program is ever run** Let's analyze how Elm enforces it's type rules:

$(5 + 2) * 3 : \text{number}$

The typing rule for +
is:

$e1 + e2 : \text{number}$
if
 $e1 : \text{number}$
and
 $e2 : \text{number}$

We know

$5 : \text{Int}$
and
 $2 : \text{Int}$
so
 $5 + 2 : \text{Int}$

The typing rule for *
is:

$e1 * e2 : \text{number}$
if
 $e1 : \text{number}$
and
 $e2 : \text{number}$

Data types & operators

Now lets learn a new operator ++

The typing rule for ++
is:

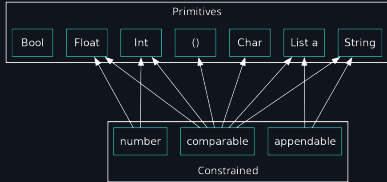
$e1 ++ e2 : \text{appendable}$

if

$e1 : \text{appendable}$

and

$e2 : \text{appendable}$



Anyone can figure out a valid expression with ++?

Data types & operators

$$\begin{aligned} & \text{"Hello"} : \text{String} + + \text{"world"} : \text{String} \Rightarrow \\ & \text{"Helloworld"} : \text{String} \end{aligned}$$

Data types & operators

Finally let's analyze the expression:

$"Hello" ++ 2$
 $"Hello" ++ 2 : \text{appendable}$
if
 $"Hello" : \text{appendable} \checkmark$
and
 $2 : \text{appendable} \times$

So `"Hello" ++ 2` does not have a type, and we say it's an **ill-typed expression**
Ill-typed programs are not evaluated

NodeJs

You can download and install the prebuilt <https://nodejs.org/en/download>

Verify your installation with these two commands:

```
node --version
```

```
npm --version
```

Download Node.js®

Get Node.js® v24.12.0 (LTS) for Windows using Chocolatey with npm

Info: Want new features sooner? Get the latest Node.js version instead and try the latest improvements.

Info: Installation methods that involve community software are supported by the teams maintaining that software.

```
1 # Download and install Chocolatey:
2 powershell -c "irm https://community.chocolatey.org/install.ps1|iex"
3
4 # Download and install Node.js:
5 choco install nodejs --version="24.12.0"
6
7 # Verify the Node.js version:
8 node -v # Should print "v24.12.0".
9
10 # Verify npm version:
11 npm -v # Should print "11.6.2".
```

PowerShell Copy to clipboard

Chocolatey is a package manager for Windows. If you encounter any issues please visit [Chocolatey's website](#).

Or get a prebuilt Node.js® for Windows running a x64 architecture.

~~Windows Installer (.msi)~~ Standalone Binary (.zip)

 Elm

Choose your os from: <https://guide.elm-lang.org/install/elm>

Verify your installation with the command:

```
elm
```

Editor integration

Choose your editor and follow the instructions at:
<https://github.com/elm/editor-plugins>

Elm tooling

Run the command:

```
npm install -g elm-test elm-format elm-review
```