Lean

PENG

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Contents

1 Introduction

Lean is a strict pure functional language with dependent types [1].

1.1 Ealuating Expressions

1.2 Types

Every expression in Lean must have a type before it can be evaluated.

Definition 1.1 (type)**.**

- `Nat`*: default, natural numbers* ≥ 0
- `Int`
- `String`
- `Bool`

Example 1.2.

```
#eval (1 - 2 : Nat) -- 0
#check (1 - 2 : Int) -- check the type of an expression
```

1.3 Functions and Definitions

Definition 1.3 (definition)**.**

```
def var : type := value
```

Example 1.4.

```
def hello := "Hello"
def lean : String := "Lean"
#eval String.append hello (String.append " " lean)
```

1.3.1 Defining Functions

Definition 1.5 (function)**.**

```
def func (arg1 : type) ... (argn : type) : type := body
```

Example 1.6.

```
def maximum (n : Nat) (m : Nat) : Nat :=
if n < m then
m
else n
#eval maximum 2 3
#check maximum
```

Remark 1.7. *All functions actually expect precisely one argument. Functions to take more than one arguments are in fact functions that take one argument and then return a new function.*

1.3.2 Defining Types

References

[1] David Thrane Christiansen. *Functional programming in Lean*. 2023.