How to Implement a PL in < 10min

Programming languages are cool!

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Background

- In addition to studying subjects like algorithms, databases, operating systems, etc. in college
- I spent a lot of time studying Programming Language theory
  - What makes a good programming language?
  - How to implement programming languages?
- Language design opens possibilities
- Helps you evaluate language features

What Language?

- Hint: we're not going to implement C# in 10 minutes.

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- IMP (short for imperative), a very simple programming language

```
# Compute nth triangle number
n := 5;
i := n;
result := 0;
while i > 0 do (
  result := result + i;
  i := i - 1
);
print n
```

Basics

- For a typical interpreted programming language like Python or Javascript we have:

$$\text{Source Code} \xrightarrow{\text{Parser}} \text{AST} \xrightarrow{\text{Interpreter}} \text{Program Output}$$

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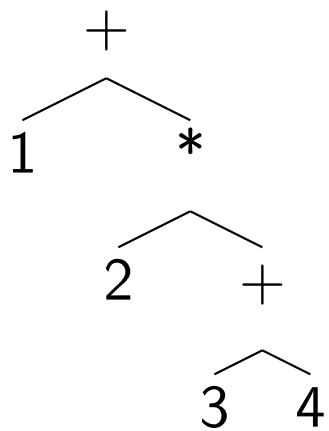
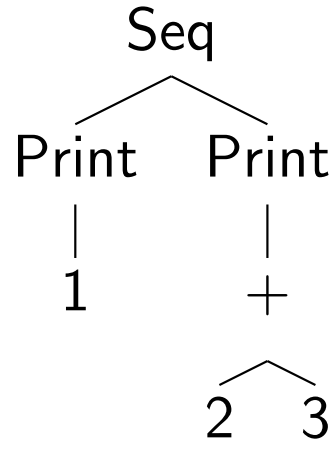
- Only going to implement an interpreter; so we'll start with Abstract Syntax Trees (ASTs)
- An expression like $1 + 2 * (3 + 4)$ would be represented as this AST:



Demo Outline

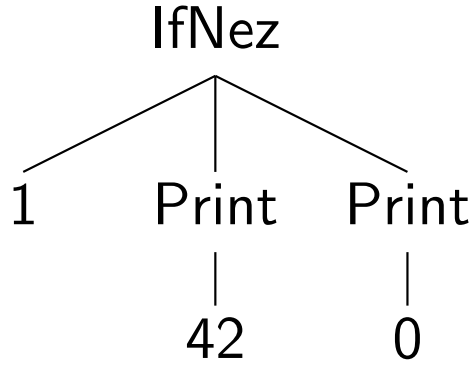
- Printing + Basic command stuff

```
print 1;
print (2 + 3)
```



- Assignment
- Conditionals (e.g. if)

```
if 1
then print 42
else print 0
```



- While

That's all!

- A more complete implementation of this simple language including a parser + repl can be found at https://github.com/lehmacdj/imp-lang. It is a little bit "better" of an implementation too:
  - It separates out booleans as a separate type from integers
  - It supports a fuller range of operations (e.g. all comparison operators and boolean operators; more arithmetic operations)
  - It is purer (it doesn't use IORef + IO in the evaluator)

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- Questions? (hopefully I didn't go overtime)