Evaluation

Part 1

Evaluation

Evaluation is the process of **computing** a value from some program.

Example Evaluation

```
2 + 2

⇝ 4
```

Example Evaluation

```
first (2,42)

⇝ 2
```

Example Evaluation

```
second (2,42)

⇝ 42
```

Example Evaluation

```
var numbers = new List<int> { 6, 2, 8, 3 };

numbers.Aggregate(func: (result, item) => result + item)
⇝ 19 = (((6+2)+8)+3)
```

The question

```
program

⇝ value
```

How do we describe the process from program to value?

Iffy Lang

$$b ::= \mathsf{T} \mid \mathsf{F} \mid \mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3$$

Iffy Lang

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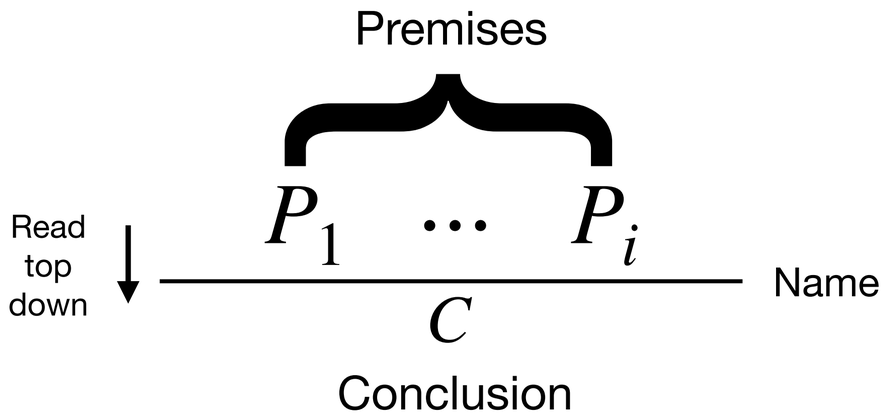
How do we evaluate Iffy Lang programs to values?

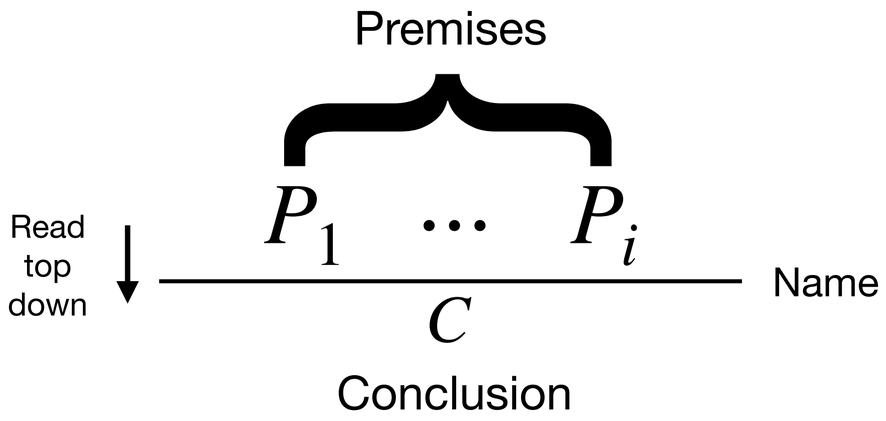
Inference Rules

$$\frac{P_1 \quad \cdots \quad P_i}{C}\ \text{Name}$$

Inference Rules



Inference Rules



Name

$\Leftrightarrow$ if $P_1 \wedge \cdots \wedge P_i$ then C

Iffy Lang Evaluation: Axioms

$$b ::= \mathsf{T} \mid \mathsf{F} \mid \text{if } b_1 \text{ then } b_2 \text{ else } b_3$$

$$\frac{}{\text{if } T \text{ then } b_2 \text{ else } b_3 \rightsquigarrow b_2}\ \text{ifT} \qquad \frac{}{\text{if } F \text{ then } b_2 \text{ else } b_2 \rightsquigarrow b_3}\ \text{ifF}$$

Iffy Lang Evaluation: Congruences

$$b ::= \mathsf{T} \mid \mathsf{F} \mid \mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3$$

$$\frac{b_1 \rightsquigarrow b_1'}{\mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3 \rightsquigarrow \mathsf{if}\ b_1'\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3}\ \mathsf{if}_1 \qquad \frac{b_2 \rightsquigarrow b_2'}{\mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3 \rightsquigarrow \mathsf{if}\ b_1\ \mathsf{then}\ b_2'\ \mathsf{else}\ b_3}\ \mathsf{if}_2$$

$$\frac{b_3 \rightsquigarrow b_3'}{\mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3 \rightsquigarrow \mathsf{if}\ b_1\ \mathsf{then}\ b_2\ \mathsf{else}\ b_3'}\ \mathsf{if}_3$$

So how do we use these rules to evaluate programs?

That y’all will learn in class.