

Compilers and Formal Languages

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Slides & Progs: KEATS (also homework is there)

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```
start := 1000;
x := start;
y := start;
z := start;
while 0 < x do {
  while 0 < y do {
    while 0 < z do { z := z - 1 };
    z := start;
    y := y - 1
  };
  y := start;
  x := x - 1
}
```

While-Language

Stmt ::= skip

| *Id* := *AExp*

| if *BExp* then *Block* else *Block*

| while *BExp* do *Block*

Stmts ::= *Stmt* ; *Stmts*

| *Stmt*

Block ::= { *Stmts* }

| *Stmt*

AExp ::= ...

BExp ::= ...

Aexprs

$$\text{eval}(n) \stackrel{\text{def}}{=} n$$

$$\text{eval}(a_1 + a_2) \stackrel{\text{def}}{=} \text{eval}(a_1) + \text{eval}(a_2)$$

$$\text{eval}(a_1 - a_2) \stackrel{\text{def}}{=} \text{eval}(a_1) - \text{eval}(a_2)$$

$$\text{eval}(a_1 * a_2) \stackrel{\text{def}}{=} \text{eval}(a_1) * \text{eval}(a_2)$$

$$\text{eval}(x) \stackrel{\text{def}}{=} ???$$

Interpreter

$\text{eval}(n, E)$

$\stackrel{\text{def}}{=} n$

$\text{eval}(x, E)$

$\stackrel{\text{def}}{=} E(x)$ lookup x in E

$\text{eval}(a_1 + a_2, E)$

$\stackrel{\text{def}}{=} \text{eval}(a_1, E) + \text{eval}(a_2, E)$

$\text{eval}(a_1 - a_2, E)$

$\stackrel{\text{def}}{=} \text{eval}(a_1, E) - \text{eval}(a_2, E)$

$\text{eval}(a_1 * a_2, E)$

$\stackrel{\text{def}}{=} \text{eval}(a_1, E) * \text{eval}(a_2, E)$

$\text{eval}(a_1 = a_2, E)$

$\stackrel{\text{def}}{=} \text{eval}(a_1, E) = \text{eval}(a_2, E)$

$\text{eval}(a_1 \neq a_2, E)$

$\stackrel{\text{def}}{=} \neg(\text{eval}(a_1, E) = \text{eval}(a_2, E))$

$\text{eval}(a_1 < a_2, E)$

$\stackrel{\text{def}}{=} \text{eval}(a_1, E) < \text{eval}(a_2, E)$

An Interpreter (1)

```
{  
  x := 5;  
  y := x * 3;  
  y := x * 4;  
  x := u * 3  
}
```

the interpreter has to record the value of x before assigning a value to y

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assigning a value to y

`eval(stmt, env)`

Interpreter (2)

$$\text{eval}(\text{skip}, E) \stackrel{\text{def}}{=} E$$

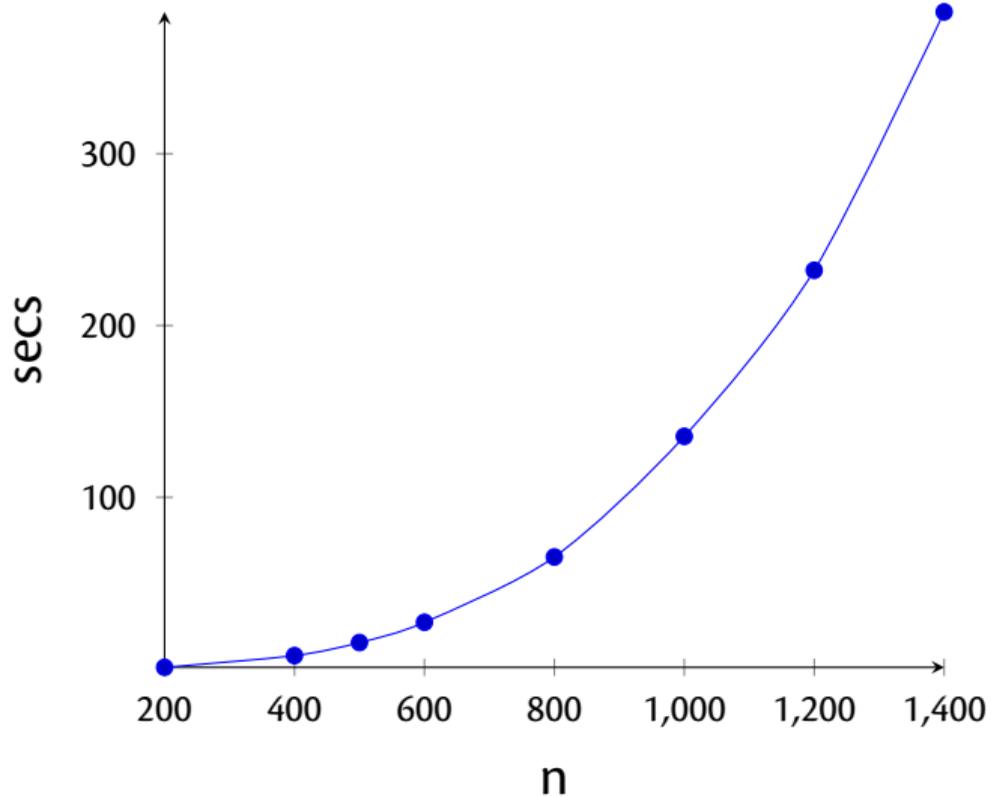
$$\text{eval}(x := a, E) \stackrel{\text{def}}{=} E(x \mapsto \text{eval}(a, E))$$

$$\text{eval}(\text{if } b \text{ then } cs_1 \text{ else } cs_2, E) \stackrel{\text{def}}{=} \\ \text{if } \text{eval}(b, E) \text{ then } \text{eval}(cs_1, E) \\ \text{else } \text{eval}(cs_2, E)$$

$$\text{eval}(\text{while } b \text{ do } cs, E) \stackrel{\text{def}}{=} \\ \text{if } \text{eval}(b, E) \\ \text{then } \text{eval}(\text{while } b \text{ do } cs, \text{eval}(cs, E)) \\ \text{else } E$$

$$\text{eval}(\text{write } x, E) \stackrel{\text{def}}{=} \{ \text{println}(E(x)) ; E \}$$

Interpreted Code



In CW3, in the collatz program there is the line write "\n" Should this print "/n" or perform the new line command /n ? Also should write be print() or println() ?

When will we have the mid-term that was originally scheduled for last week? We haven't heard anything about it for 2 weeks.

