Part I
An interpreter takes a program and returns its value:

**Plait** = the language that we use to write interpreters

**Curly** = the language that is to be interpreted

...that keeps changing
Curly Arithmetic

\{+ \ 2 \ 1\}

\rightarrow 3
Curly Arithmetic

\{ * 2 1 \} \\
\rightarrow 2
Curly Arithmetic

\{ + 2 \{ * 4 3 \} \} → 14
Curly Arithmetic

2

→ 2
Representing Expressions

2

{ + 2 1 }

{ + 2 { * 4 3 } }

• numbers
• addition expressions
  ◦ first and second arguments are expressions
• multiplication expressions
  ◦ first and second arguments are expressions
Representing Expressions

2

{ + 2 1 }

{ + 2 { * 4 3 } }

(define-type Exp
  (numE [n : Number])
  (plusE [l : Exp][r : Exp])
  (multE [l : Exp][r : Exp])))
Part 2
Curly Interpreter

(define (interp [a : Exp]) : Number
  (type-case Exp a
    [(numE n) n]
    [(plusE l r) (+ (interp l) (interp r))]
    [(multE l r) (* (interp l) (interp r))])))

(test (interp (numE 2)) 2)
(test (interp (plusE (numE 2) (numE 1))) 3)
(test (interp (multE (numE 2) (numE 1))) 2)
(test (interp (plusE (multE (numE 2) (numE 3)) (plusE (numE 5) (numE 8)))) 19)
Part 3
Concrete vs. Abstract Syntax

\{ + 2 1 \}

(\texttt{plusE \ (numE 2) \ (numE 1)})
Concrete Syntax as an S-Expression

`{+ 2 1}

(test (parse `{+ 2 1})
  (plusE (numE 2) (numE 1)))
Concrete Syntax as an S-Expression

; An EXP is either
;   - `NUMBER
;   - `{+ EXP EXP}
;   - `{* EXP EXP}
Concrete Syntax as an S-Expression

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  (numE [n : Number])
  (plusE [l : Exp] [r : Exp])
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Concrete Syntax as an S-Expression

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;   - `NUMBER
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(define-type Exp
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  (plusE [l : Exp] [r : Exp])
  (multE [l : Exp] [r : Exp]))
Matching an S-Expression

; An EXP is either ...
;  - `{* EXP EXP}

(define (parse [s : S-Exp]) : Exp
    ....

    ....)
Matching an S-Expression

; An EXP is either ...
; - `* EXP EXP

(define (parse [s : S-Exp]) : Exp
  ....
  (and (s-exp-list? s)
       (= 3 (length (s-exp->list s)))
       (s-exp-symbol? (first (s-exp->list s)))
       (eq? ' * (s-exp->symbol (first (s-exp->list s))))))

  ....)
Matching an S-Expression

; An EXP is either ...
; - `{* EXP EXP}

(define (parse [s : S-Exp]) : Exp
....

(s-exp-match? `{* ANY ANY} s)

....)
Matching an S-Expression

; An EXP is either ...
;  - `{* EXP EXP}

(define (parse [s : S-Exp]) : Exp
    ....
    (cond
        ....
        [(s-exp-match? `{* ANY ANY} s)
            .... (parse (second (s-exp->list s)))
            .... (parse (third (s-exp->list s))) ....]
        ....)
    ....)