

Peer feedback:

fill out feedback form
when finished, discuss w/ partner

give Lucy form + printed solution - they
will be scanned right after class and
put on canvas

Written HW Logistics:

I will ask for resubmissions if:

- no citations
- no chat transcripts
- starting HW 2, probs not on separate pages

Formal Languages and Regular Expressions

language = set of strings

ex $L = \{\text{string, array}\}$
 $\{0, 1\}^*$

The set of all Python programs that print "Hello, world!"

	language?	length/size?
\emptyset	yes	0
ϵ	no	$ \epsilon = 0$
$\{\epsilon\}$	yes	1

$L = \{w \in \{0, 1\}^* : w \text{ has an even number of 1s}\}$

$0101 \notin L$ $00 \in L$ $\epsilon \in L$ $1 \notin L$

Familiar set operations

A, B languages

$$L = A \cup B$$

$$L = A \cap B$$

$$L = A \setminus B$$

New operations:

concatenation

$$L = A \bullet B = \{x \bullet y : x \in A \text{ and } y \in B\}$$

$$A = \{\text{black}, \text{blue}\}$$

$$B = \{\text{berry}, \text{fish}\}$$

$$A \bullet B = \{\text{blackberry}, \text{blueberry}, \text{black fish}, \text{blue fish}\}$$

$$|A \bullet B| = |A| \cdot |B|$$

$$|A|, |B|$$

$$\emptyset \bullet A = \{\} \bullet \{\text{black}, \text{blue}\} = \emptyset$$

what language has property
 $B \bullet L = L$ for all L ?

$$B = \{\epsilon\}$$

Kleene Star

A^* = concatenation of any string in A

$w \in A^*$ if and only if $\begin{cases} w = \epsilon \text{ or} \\ w = x \bullet y \text{ where} \\ x \in A \text{ and} \\ y \in A^* \end{cases}$

ex $A = \{ba, bar\}$

$$\epsilon \quad w = \epsilon \quad \epsilon \in A^*$$

$$ba \in A^*$$

$$\begin{array}{ccc} & ba \bullet \epsilon & \\ \nearrow & & \searrow \\ \epsilon \in A & & \epsilon \in A^* \end{array}$$

$$baba \in A^*$$

$$\begin{array}{ccc} & ba \bullet ba & \\ \nearrow & & \nwarrow \\ \epsilon \in A & & \epsilon \in A^* \end{array}$$

Regular expressions

$\{w\}$	w] notation operations allowed	↑ precedence
$A \cup B$	$A + B$		
$A \cdot B$	AB		
A^*	A^*		

$$L = \{0\} \cup (\{1\} \cdot \{0\}^*) = 0 + 10^*$$

$10 \notin \{0\}$
 \downarrow
 \times

$$0 \in L$$

$$10$$

$$1$$

$$|L| = 1$$