CPSC 421/501 Sept 27, 2024

- Review

$L = \{ p \mid p \text{ accepts} \geq 1 \text{ input} \}$

is undecidable

- Paradoxes (1) Russell's

(2) "Berry's" (likely Russell's ...)

(3) "don't write about themself"

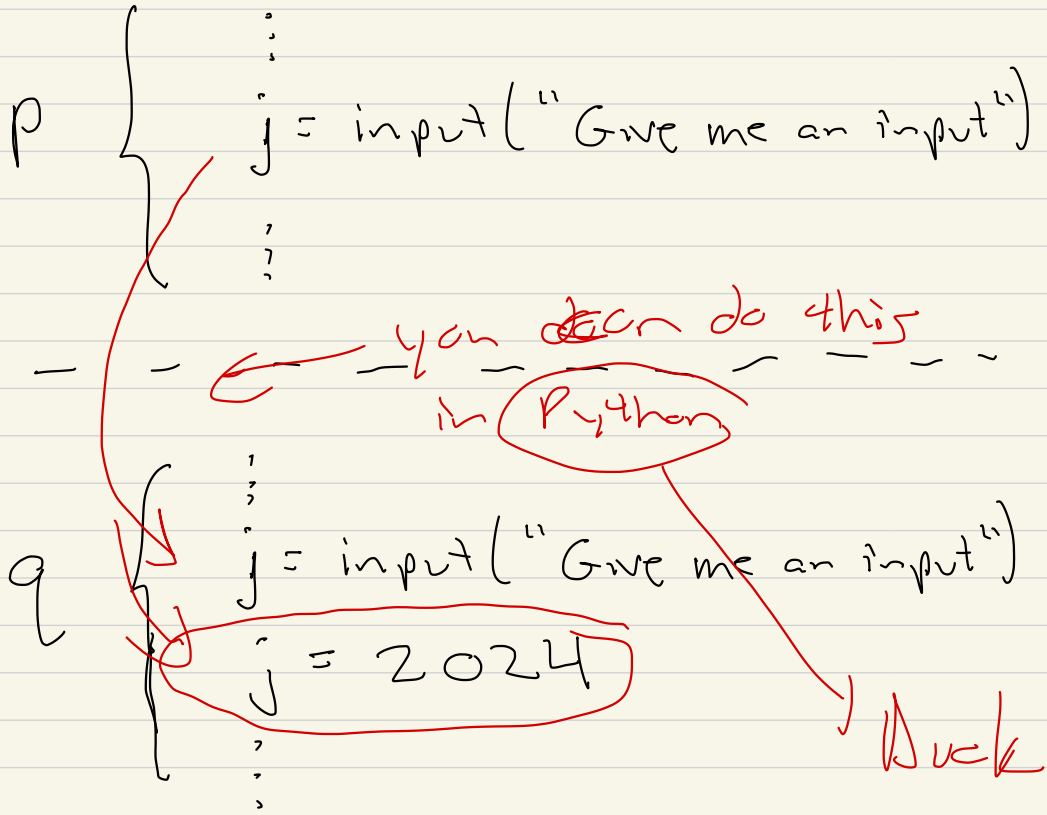
- Regular languages (Chapter 1, [Sip])

- Sept 30: Truth & Reconciliation

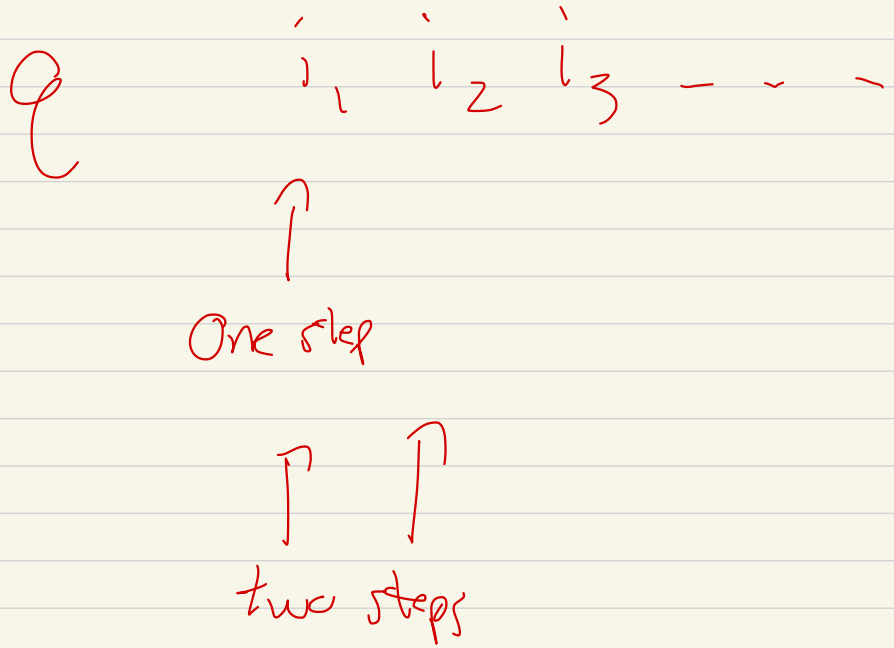
Reduce ACCEPTANCE to

$L = \{q \mid q \text{ accepts } \geq 1 \text{ input}\}$

Example: $p \sigma_0$ 2024 where



To recognize L



Cantor's Theorem: Let $f : S \to \text{Power}(S)$

then $T = \{ s \in S \mid s \notin f(s) \}$ ....

S: "This statement, S, is a lie."

Russell's Paradox:

Let T be the set

$$T = \{ S \mid S \notin S \}.$$

Does $T \in T$? $\Leftrightarrow$

$S = T$, $S \notin S$ $\Leftrightarrow$ $T \notin T$

"Berry" Paradox: Let n be the smallest positive integer not described by an English sentence with fewer than fifty words. (fifty = 50).

$n = 7125349172\ldots23$

↳ ?!

about and only about

"Leslie writes about everyone in town who does not write about themself."

Does Leslie write about Leslie

Regular Languages

$\{$Duck-recognizable$\}$

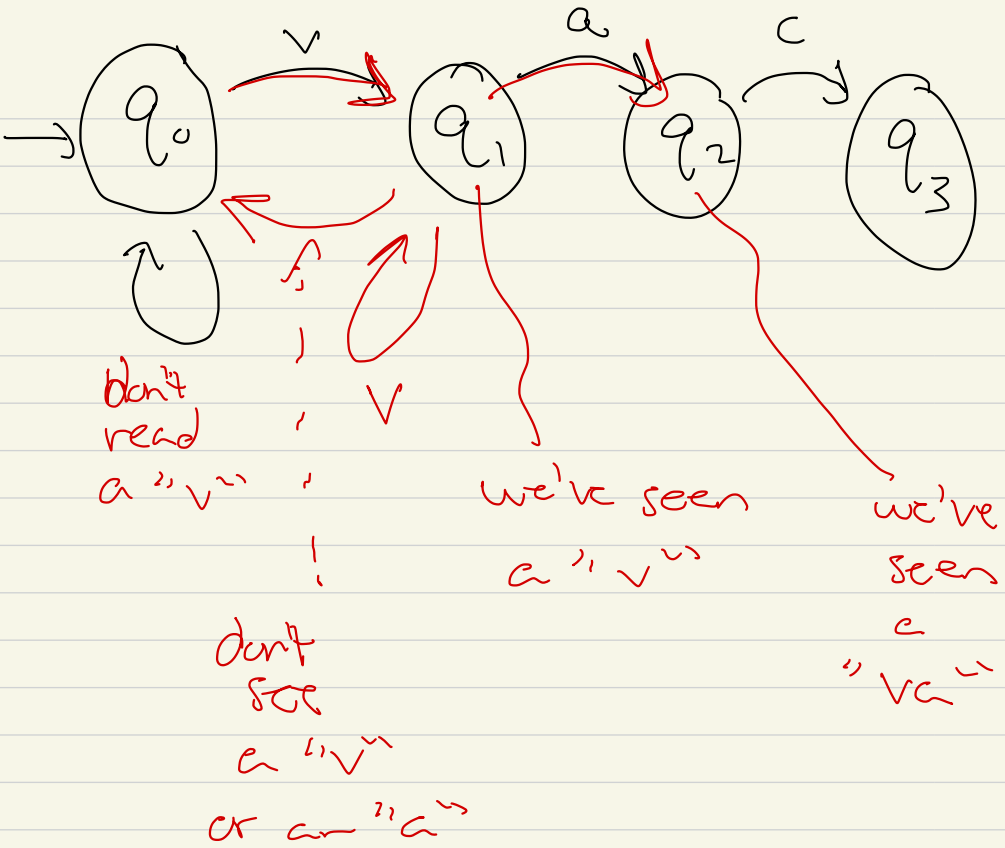
$\subsetneq \{$Regular Languages$\}$

$\subsetneq \{$Python-recognizable languages$\}$

Motivation:

$$L = \{ s \in \Sigma^*_{ASCII} \mid \begin{array}{l} s \text{ contains} \\ \text{the word} \\ \text{"vacation" as} \\ \text{a substring} \end{array} \}$$

Simple algorithm: letter by letter
symbol by symbol



Finite automaton: $(Q, \Sigma, \delta, q_0, F)$

where:

Q = finite set "of states"

Σ = alphabet

$q_0 \in Q$

q_0 "the initial state"

$F \subseteq Q$

F : final states

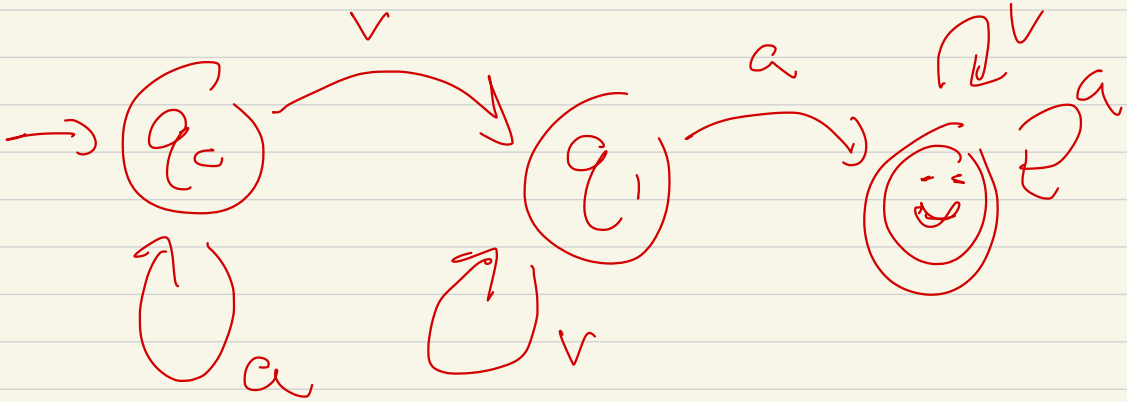
accepting states

$\delta : Q \times \Sigma \rightarrow Q$

e.g.

$$\Sigma = \{v, a\}$$

$$L = \{ s \mid \text{"}s \text{ contains } va \text{ somewhere"} \}$$



$$F = \{ \text{☺} \}$$

$Q = \{q_0, q_1, \text{☺}\}$

$F = \{\text{☺}\}$

$\Sigma = \{v, a\}$

q_0 is q_0 the initial state

δ : $\delta(q_0, a) = q_0$

$\delta(q_0, v) = q_1$

$\delta(q_1, v) = q_1$, $\delta(q_1, a) =$ ☺

DFA — automaton

finite

deterministic