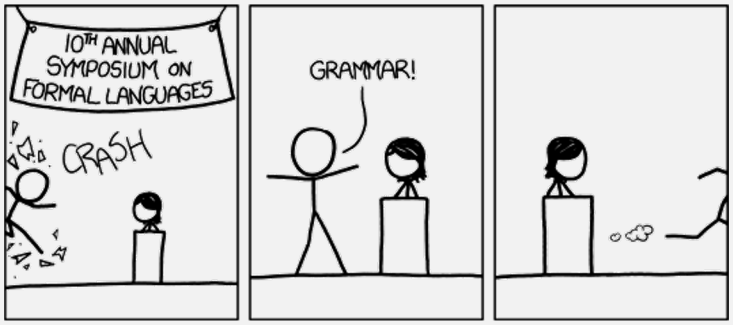
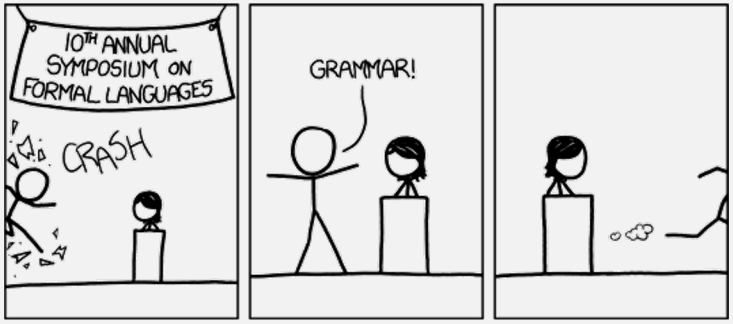
Pushdown Automata (PDAs) Pt 1



Announcements

- Exam Tomorrow
  - 8:00am-10:00pm EST
  - Instructions and Gradescope
- Homework due shortly after
- Homework 3 Data + Analysis
- Exam Review / Q&A 1st pt class

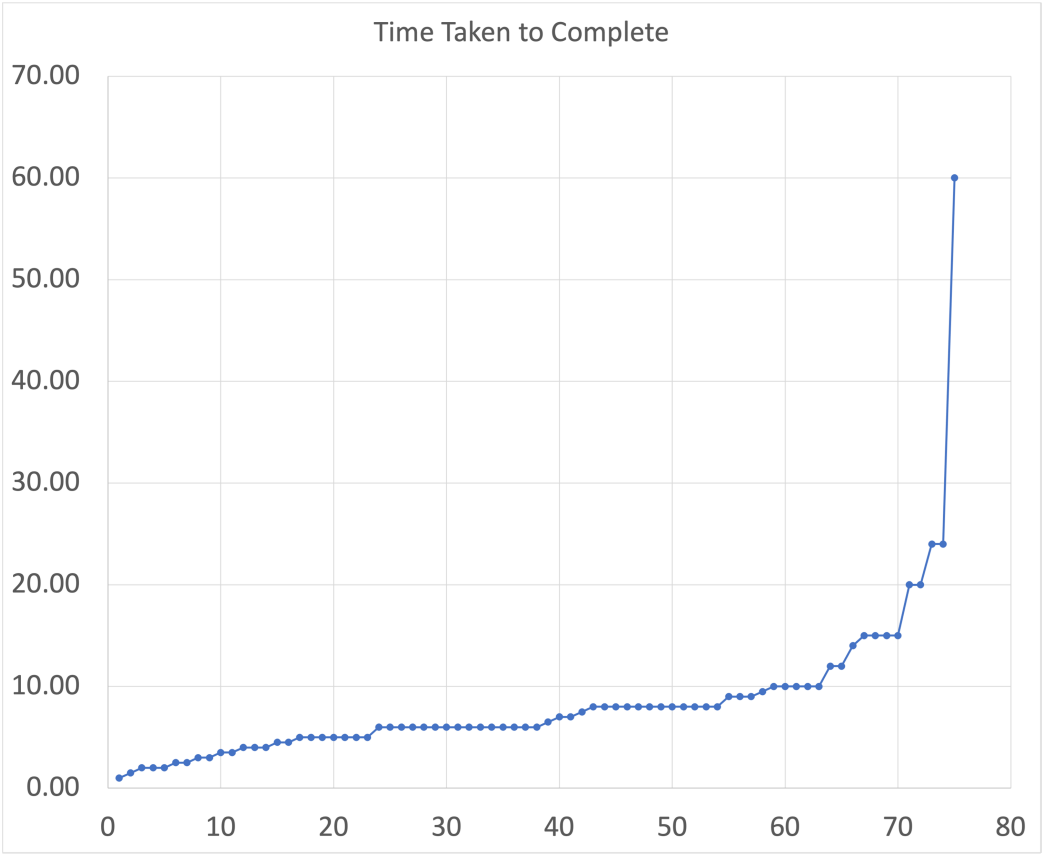


Hours / # ppl <=

“20+”

Blanks/no submissions

ranges



Last Time:

Regular Languages	Context-Free Languages (CFLs)
Regular Expression (Regexp)	Context-Free Grammar (CFG)
A Reg expr describes a Regular lang	A CFG describes a CFL

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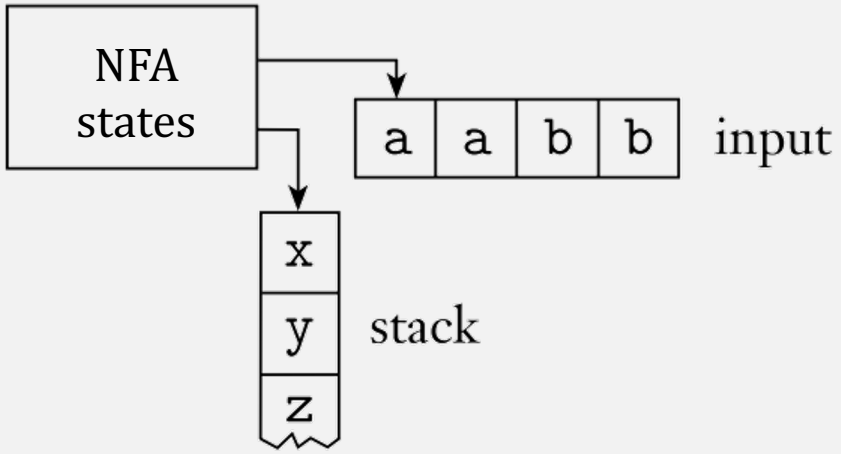
Finite automaton (FSM)	Push-down automaton (PDA)
An FSM recognizes a Regular lang	A PDA recognizes a CFL
DIFFERENCE:	**DIFFERENCE:**
A Regular lang is defined with a FSM	A CFL is defined with a CFG
Proven: Reg expr ⇔ Reg lang	*Must prove*: PDA ⇔ CFL

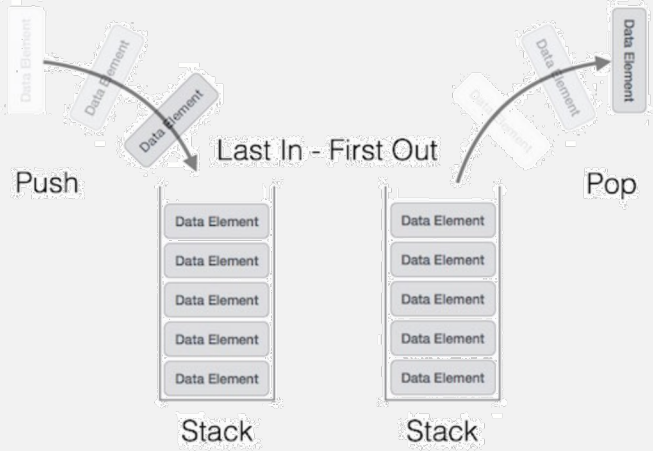
Pushdown Automata (PDA)

- PDA = NFA + a stack



A (Mathematical) Stack Specification

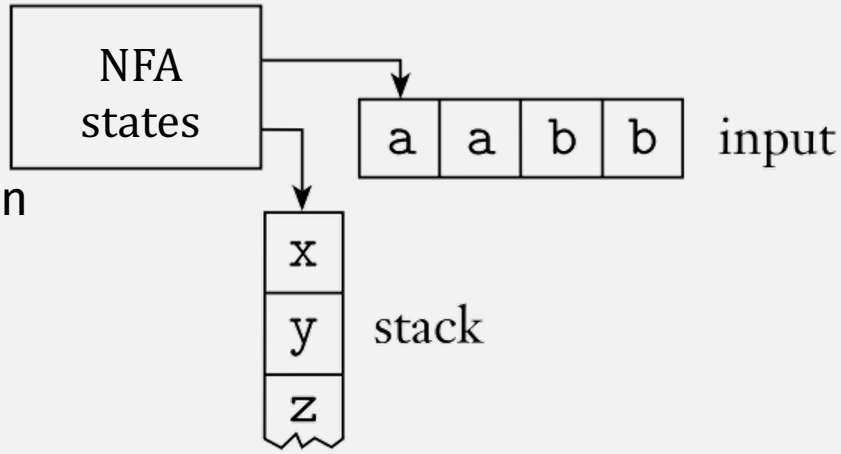
- Access to top element of stack only
- Operations: push, pop



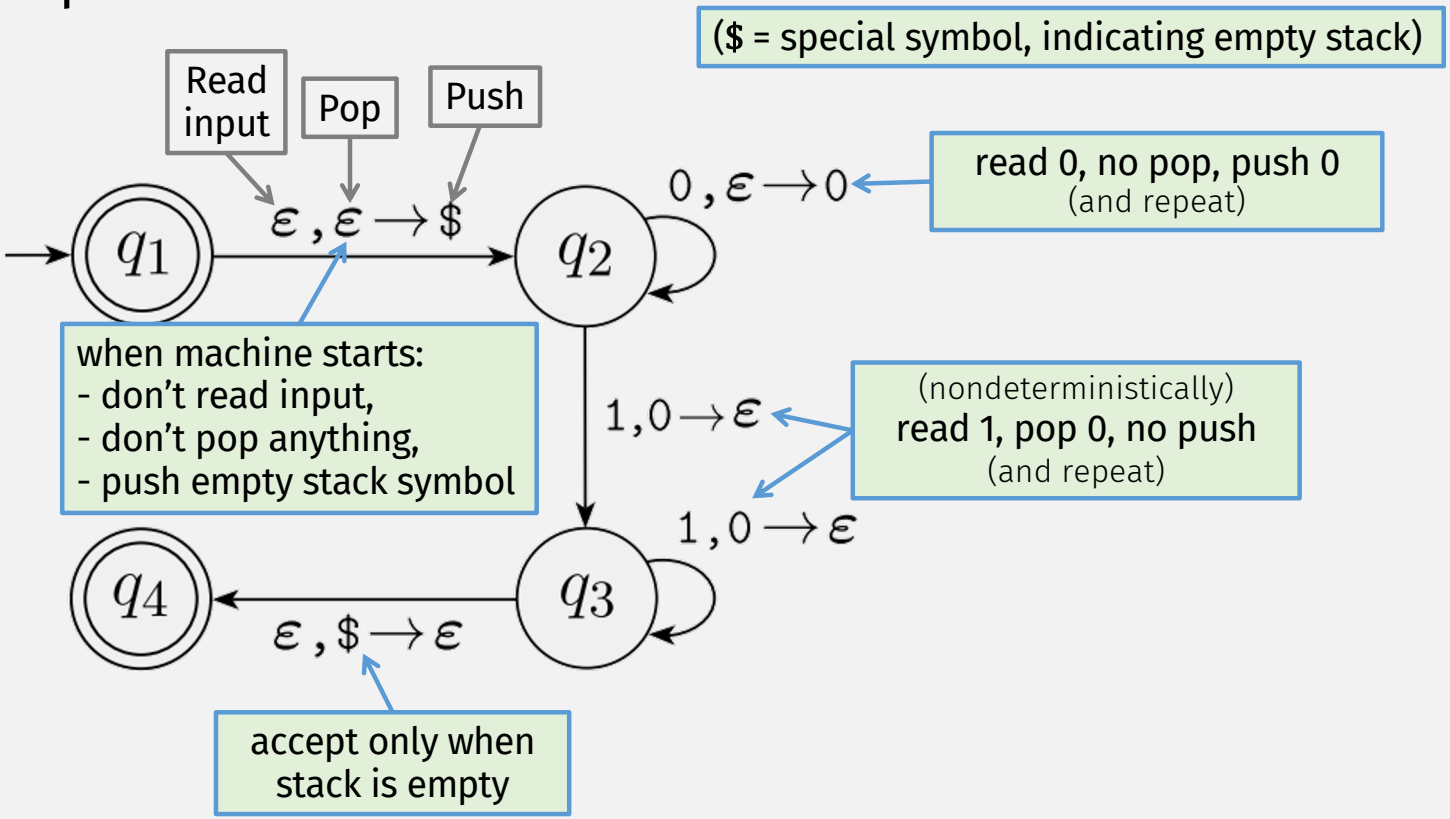
- (What could be a possible data representation in code?)

Pushdown Automata (PDA)

- PDA = NFA + a stack
  - Infinite memory
  - Can only read/write top location
    - Push/pop



An Example PDA $\{0^n 1^n \mid n \geq 0\}$



Formal Definition of PDA

A ***pushdown automaton*** is a 6-tuple $(Q, \Sigma, \Gamma, \delta, q_0, F)$, where Q, Σ, Γ, and F are all finite sets, and

1. Q is the set of states,
2. Σ is the input alphabet,
3. Γ is the stack alphabet,
4. $\delta: Q \times \Sigma_\varepsilon \times \Gamma_\varepsilon \longrightarrow \mathcal{P}(Q \times \Gamma_\varepsilon)$ is the transition function,
5. $q_0 \in Q$ is the start state, and
6. $F \subseteq Q$ is the set of accept states.

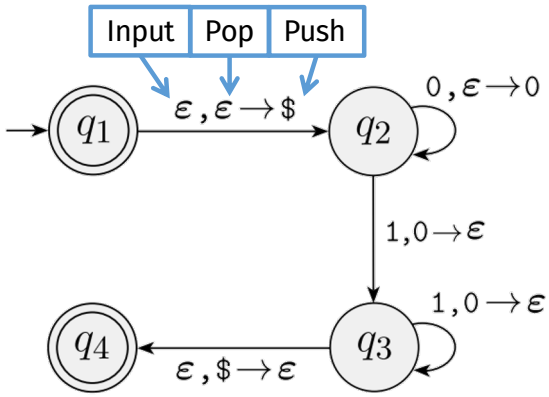
Stack alphabet can have special stack symbols, e.g., $

Input

Pop

Push

In-class example



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Input Pop Push

Check-in Quiz

On Gradescope