Lecture 22

Thursday, March 14, 2024 11:41 AM

* $\{a^n b^n c^n : n \geq 0\}$ is not CFL (why?)

* write a program that checks whether a given $x \in \{[,],(,)\}^*$ is a valid parenthesization.

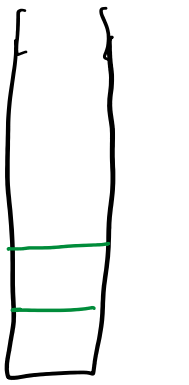
([])() ✓

([)] not valid

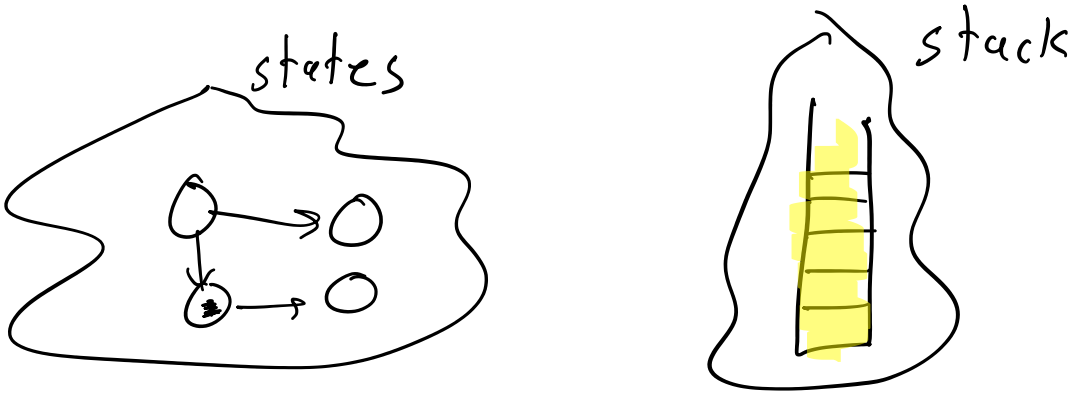
(() not valid

)(not valid

* we can use a stack and push any open brackets that we see, and pop/match them with close brackets (or reject) and the stack should become empty at the end.



Push Down Automata (PDAs)



The state gets updated based on the previous state, the current input symbol, and the top of the stack.

[Also with each transition, we can push or pop an element to the stack]

We will introduce → balanced parenthesization

Deterministic PDAs

↘ Non deterministic PDAs

↓ palindromes

* NPDAs are actually more powerful than PDAs.

* Being a CFL is equivalent [illegible] NPDA

* Being a [illegible] to having a NPDA

Given a string, check whether it can be generated by a given CFG?

$S \to [S] \mid SS \mid \varepsilon$

$S \to SS \to SSS \to SSSS \to SSSSS \to \cdots$
$\to SSSS \to SSS \to SS \to S \to [S] \to []$

we have a long sequence of derivations but the final string is short. It seems that some of the transitions are useless or they don't make any progress towards generating X.

ε-productions (e.g. $A \to \varepsilon$) are problematic.

$S \to A \mid a$
$A \to B$
$B \to S$

$S \to A \to B \to S \to A \to B \to S \to a$

unit productions (e.g. $A \to B$) are problematic.

A grammar $G = (N, \Sigma, P, S)$ is in Chomsky Normal Form (CNF) if every production in P is in one of these forms:

$A \to BC$

$D \to a$

Question: Given a CFG G, can we always find G' that is in CNF and $L(G) = L(G')$?

No, since we cannot generate ε.

Thm. $\forall$ CFG G, $\exists$ CFG G' that is in CNF and

$$L(G') = L(G) - \{\varepsilon\}$$

$S \to [S] \mid SS \mid \varepsilon$ CNF?

$S \rightarrow aSb \mid \varepsilon$ CNF?