L4.1 Equivalence of CFG and PDA (Part 1)

Equivalence of CFG and PDA (Part-1)

Theorem: A language is Context Free iff some Pushdown Automata recognizes it.

Proof: Part 1: Given a CFG, show how to construct a PDA that recognizes it.

Part 2: Given a PDA, show how to construct a CFG that recognizes the same language.

Equivalence of CFG and PDA (Part-1)

(From CFG to PDA)

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Given a grammar

$$S \rightarrow BS \mid A$$

$$A \rightarrow 0A \mid \epsilon$$

$$B \rightarrow BB1 \mid 2$$

Find or build a PDA

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S→ BS|A
A→0A|∈
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--> S
--> BS
--> BB1S
--> 2B1S
--> 221S
--> 221A
--> 221∈
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(Left most derivation)

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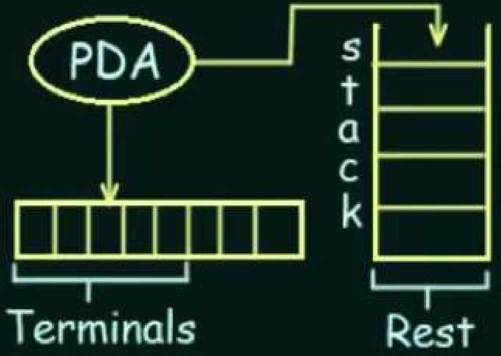

General Form:

$$\underbrace{aaaa}_{\text{Terminals}}\ \underbrace{BaBC}_{\text{Rest}}$$

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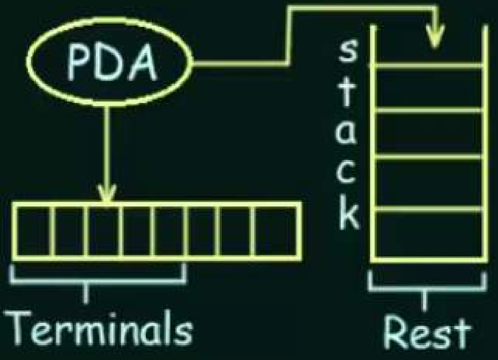

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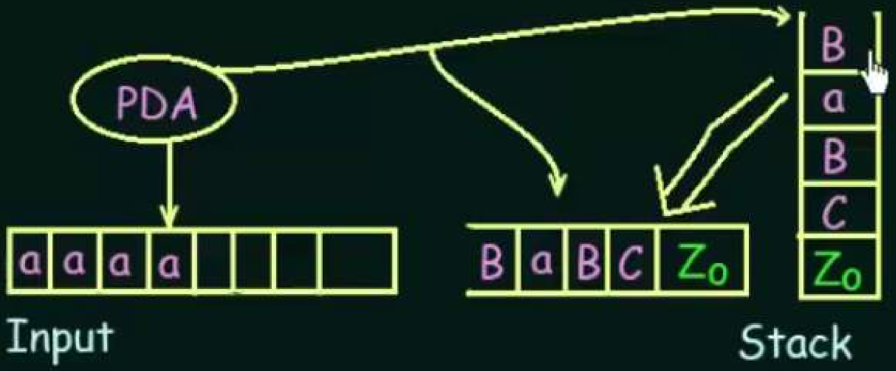
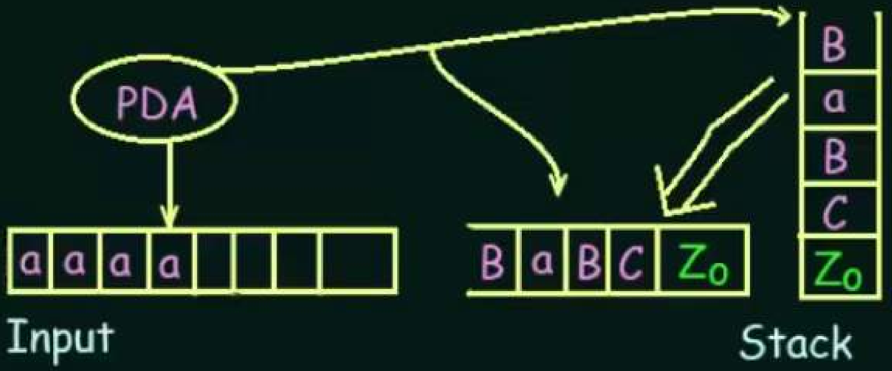


Left Most Derivation: S --> ..... a a a a B a B C --> ......

AT EACH STEP EXPAND LEFT-MOST DERIVATION

Eg. Rule: B→ASAxBA --> ..... a a a a A S A x B A a B C

- → Match Stack Top to a Rule
- → Pop Stack
- → Push Right Hand Side of Rule onto Stack



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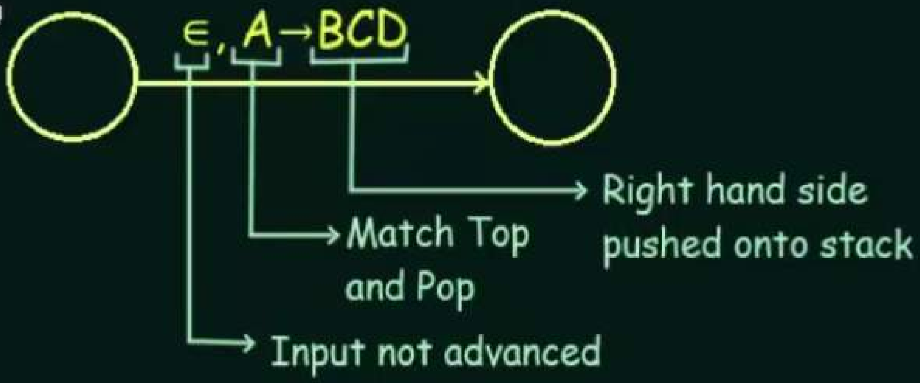
Rule: $A \rightarrow BCD$

Add this to the PDA



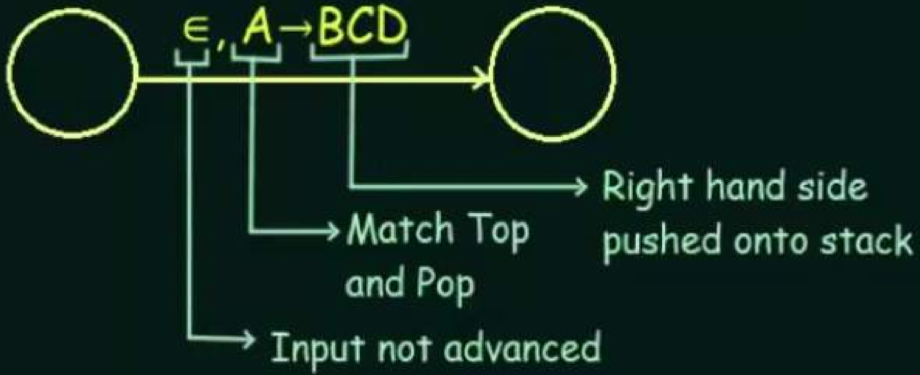
Right hand side pushed onto stack

Match Top and Pop

Input not advanced

Rule: A → BCD

Add this to the PDA



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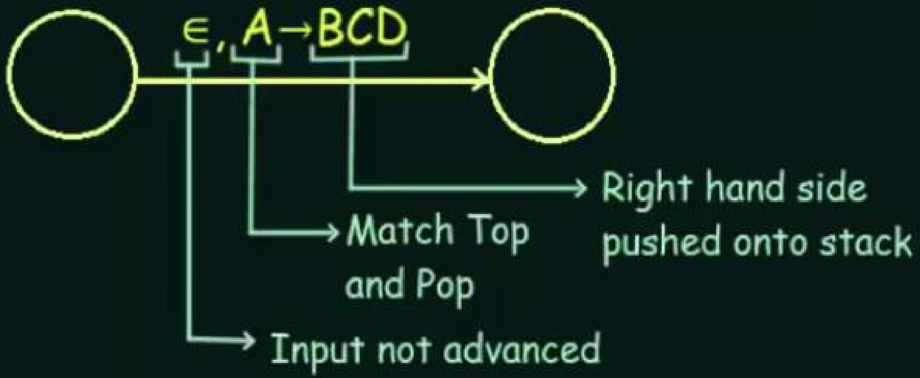
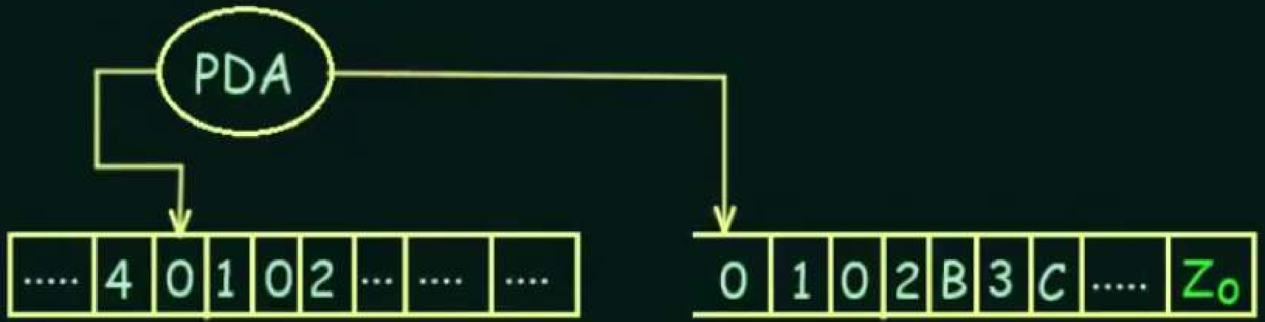


Right hand side pushed onto stack

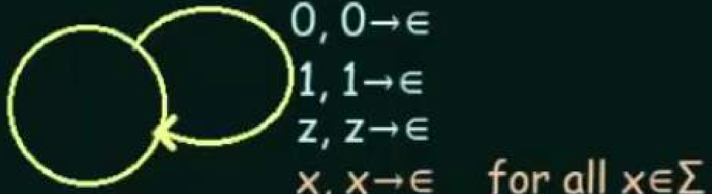
Match Top and Pop

Input not advanced

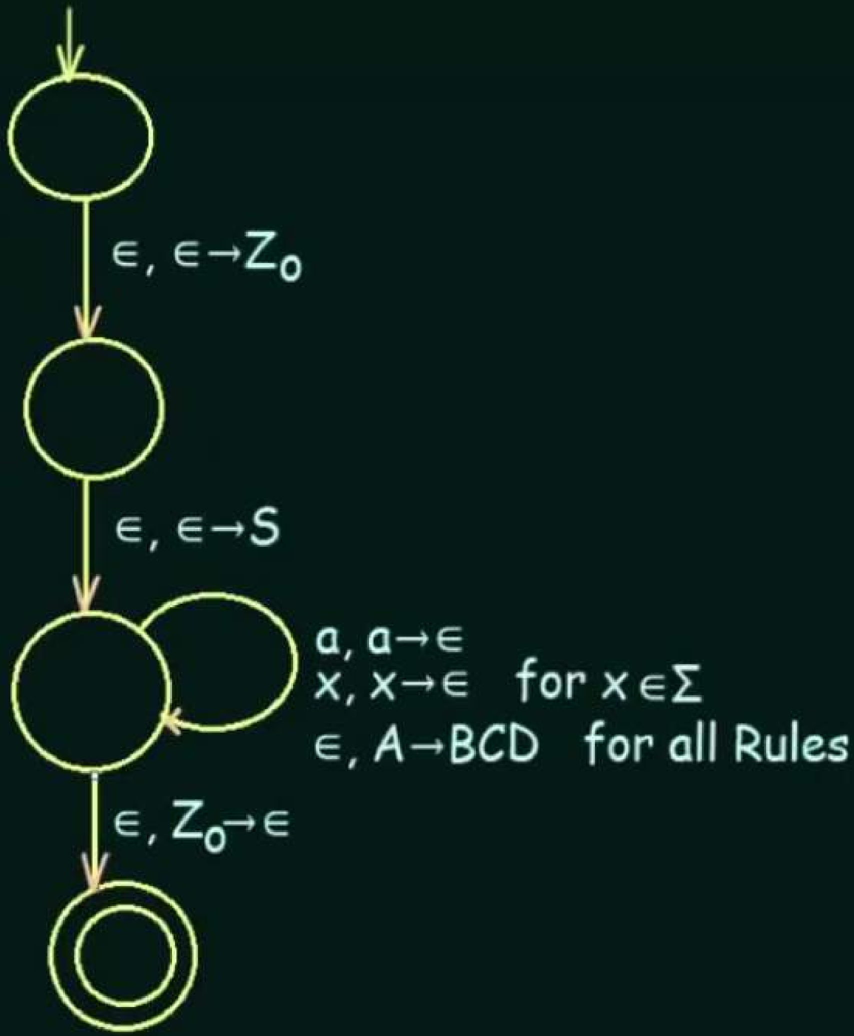
Rule: $A \rightarrow 0\ 1\ 0\ 2\ B\ 3\ C$



MATCH TERMINAL SYMBOLS TO THE STACK TOP



The Final PDA



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