



Compilers

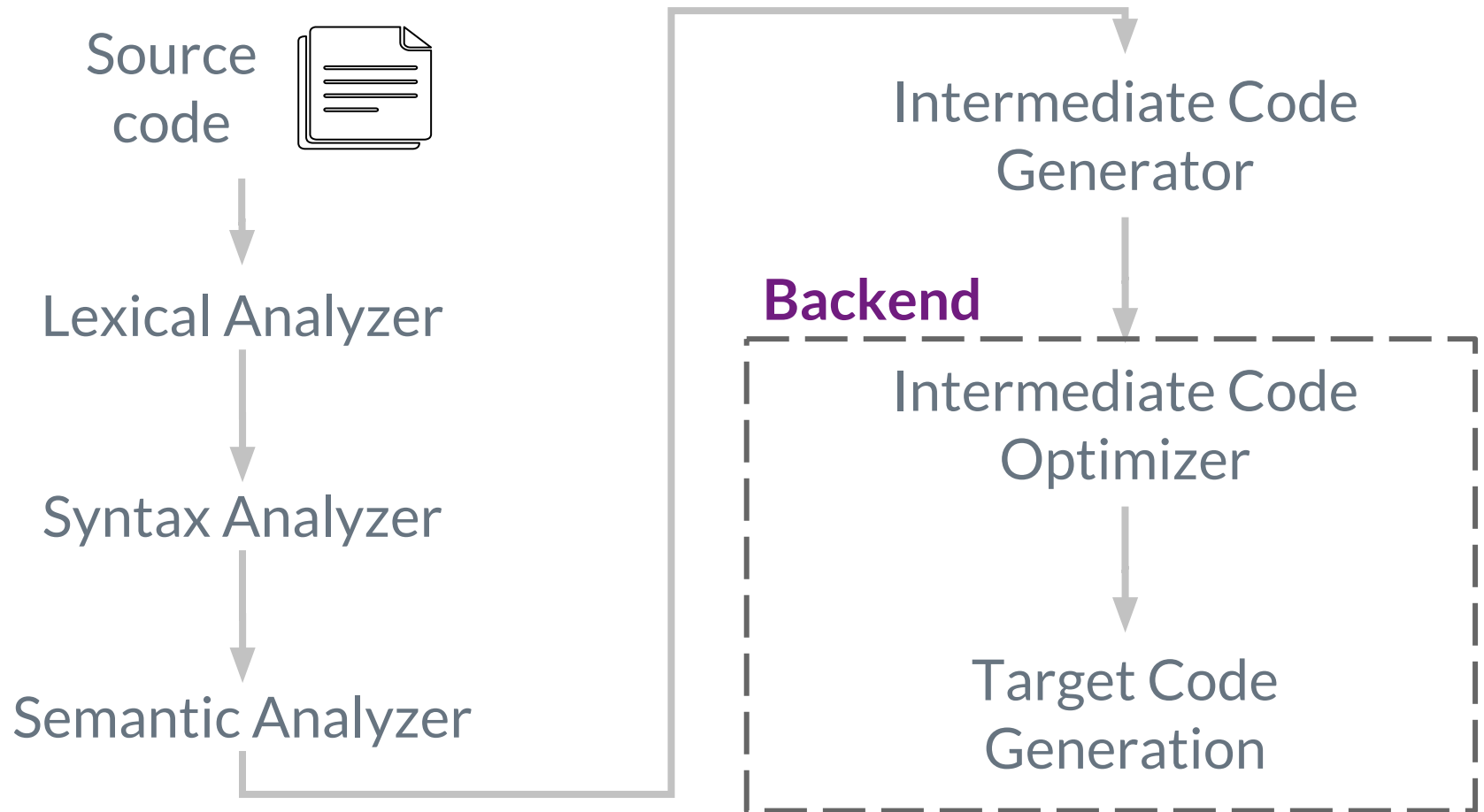
Lab V

Plan

- ▷ Overview
- ▷ Parsers overview
- ▷ First & Follow

1. Overview

Compiler phases



Compiler phases

▷ $x = a + b * c$ //statement

▷ $Id = id + id * id$

▷ Parse tree



$S \rightarrow id = E$
 $E \rightarrow E + T / T$
 $T \rightarrow T * F / F$
 $F \rightarrow id$

▷ Verify parse

tree semantically

Source
code



Lexical Analyzer

Syntax Analyzer

Semantic Analyzer

Intermediate Code
Generator

Intermediate Code
Optimizer

Target Code
Generation

Grammar

$G = (V, T, P, S)$

- ▷ V is variables
- ▷ T is terminals
- ▷ P is productions
- ▷ S is start symbol

Example :

$E \rightarrow E + E \mid$
 $E * E \mid$
 id

$G \rightarrow$

Ambiguous | Unambiguous

$G \rightarrow$

Left | Right Recursive

$G \rightarrow$

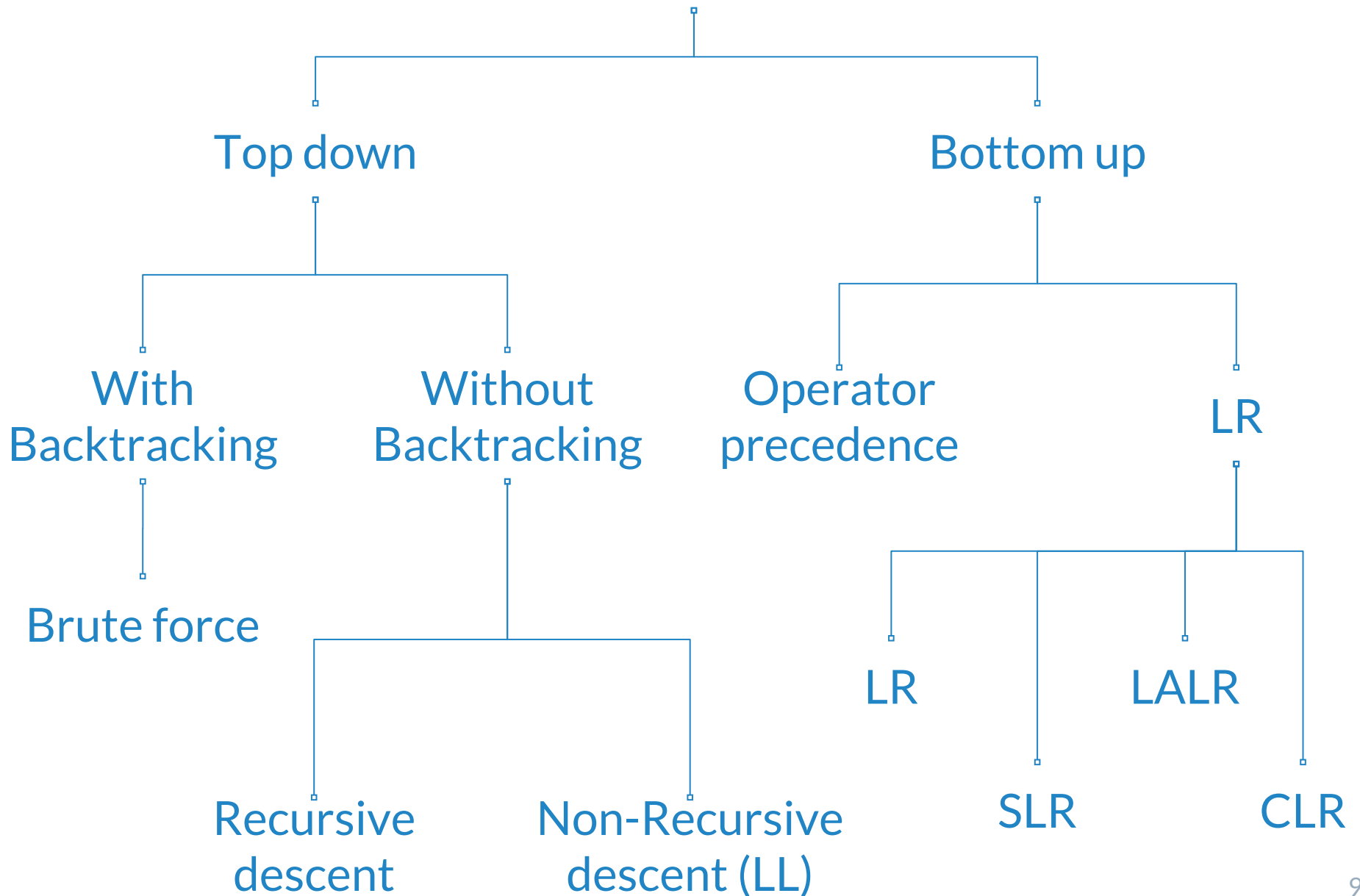
Deterministic | Non-Deter.

2. Parsers



*Parsing is the process of
analysing a string of symbols,
conforming to the rules of a
formal grammar.*

Parsers





LL parser is a top-down parser for a subset of context-free languages.

It parses the input from left to right using left-most derivation & k represents the number of look aheads

LL(1)

Example :

1. $S \rightarrow F$
2. $S \rightarrow (S + F)$
3. $F \rightarrow a$

(a + a) \$

	()	a	+	\$
S	2	-	1	-	-
F	-	-	3	-	-

\$

3. First & Follow



First & follow are needed by the parser, so that it can properly apply the needed rule at the correct position.

First & Follow

Example :

▷ $S \rightarrow A B C D$

$A \rightarrow b \mid \epsilon$

$B \rightarrow c$

$C \rightarrow d$

$D \rightarrow e$

	First	Follow
S		
A		
B		
C		
D		

First & Follow

Example :

▷ $S \rightarrow A B C D$

$A \rightarrow b \mid \epsilon$

$B \rightarrow c$

$C \rightarrow d$

$D \rightarrow e$

	First	Follow
S	b, c	\$
A	b, ϵ	c
B	c	d
C	d	e
D	e	\$

First & Follow

Example :

▷ $S \rightarrow A B C D E$

$A \rightarrow a \mid \varepsilon$

$B \rightarrow b \mid \varepsilon$

$C \rightarrow c$

$D \rightarrow d \mid \varepsilon$

$E \rightarrow e \mid \varepsilon$

	First	Follow
S		
A		
B		
C		
D		
E		

First & Follow

Example :

▷ $S \rightarrow A B C D E$

$A \rightarrow a \mid \epsilon$

$B \rightarrow b \mid \epsilon$

$C \rightarrow c$

$D \rightarrow d \mid \epsilon$

$E \rightarrow e \mid \epsilon$

	First	Follow
S	a, b, c	\$
A	a, ϵ	b, c
B	b, ϵ	c
C	c	d, e, \$
D	d, ϵ	e, \$
E	e, ϵ	\$

First & Follow

Example :

▷ $S \rightarrow A C B$
 $\quad \mid C b D$
 $\quad \mid B a$
 $A \rightarrow d a \mid B C$
 $B \rightarrow g \mid \epsilon$
 $C \rightarrow h \mid \epsilon$

	First	Follow
S		
A		
B		
C		

First & Follow

Example :

▷ $S \rightarrow A C B$
 $| C b D$
 $| B a$
 $A \rightarrow d a | B C$
 $B \rightarrow g | \epsilon$
 $C \rightarrow h | \epsilon$

	First	Follow
S	d ,g, h, ϵ , b, a	\$
A	d, g, h, ϵ	\$, h, g
B	g, ϵ	\$, a, h, g
C	h, ϵ	\$, g, b, h

Thanks!

Any questions?

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