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## LL (1) Grammars

1.  $\langle s \rangle \rightarrow \langle A \rangle b \langle B \rangle$
2.  $\langle s \rangle \rightarrow d$
3.  $\langle A \rangle \rightarrow \langle C \rangle \langle A \rangle b$
4.  $\langle A \rangle \rightarrow \langle B \rangle$
5.  $\langle B \rangle \rightarrow c \langle s \rangle d$
6.  $\langle B \rangle \rightarrow \varepsilon$
7.  $\langle C \rangle \rightarrow a$
8.  $\langle c \rangle \rightarrow ed$

### bcdd

- $\langle s \rangle \xRightarrow{1} \langle A \rangle b \langle B \rangle$
- $\langle A \rangle b \langle B \rangle \xRightarrow{4} \langle B \rangle b \langle B \rangle$
- $\langle B \rangle b \langle B \rangle \xRightarrow{6} b \langle B \rangle$
- $b \langle B \rangle \xRightarrow{5} bc \langle s \rangle d$
- $bc \langle s \rangle d \xRightarrow{2} bcdd$

	First $\alpha$	Follow( $\langle X \rangle$ )	Select( $\langle X \rangle \rightarrow \alpha$ )
1	$\langle A \rangle b = \{a, b, c, e\}$		$\{a, b, c, e\}$
2	$\{d\}$		$\{d\}$
3	$\langle C \rangle = \{a, e\}$		$\{a, e\}$
4	$\langle B \rangle = \{c\}$		$\text{First}(\langle B \rangle) + \text{Follow}(\langle A \rangle) = \{c\} + \{b\} = \{b, c\}$
5	$\{c\}$		$\{c\}$
6	$\{\}$	$\text{Follow}(\langle B \rangle) = \text{Follow}(\langle A \rangle) + \text{Follow}(\langle s \rangle)$ $= \{b\} \cup \{d, dashv\} = \{b, d, dashv\}$	$\text{Follow}(\langle B \rangle) = \{b, d, \neg\}$
7	$\{a\}$		$\{a\}$
8	$\{e\}$		$\{e\}$

4 and 6 are nullable, i.e. can derive  $\varepsilon$

	a	b	c	d	e	$\neg$
<s>	1	1	1	2	1	
<A>	3	4	4		3	
<B>	6	6	5	6	6	
<C>	7				8	
b		Pop, Advance				
d				Pop, Advance		
$\nabla$						

1. Replace(<B>b<A>), Retain
2. Pop, Advance
3. Replace(b<A><C>), Retain
4. Replace(<B>), Retain
5. Replace(d<s>), Advance
6. Pop, Retain
7. Pop, Advance
8. Replace(d), Advance

## Is an Grammar LL?

### Grammar

1.  $\langle E \rangle \rightarrow \langle T \rangle \langle E\text{-List} \rangle$
2.  $\langle E\text{-List} \rangle \rightarrow + \langle T \rangle \langle E\text{-List} \rangle$
3.  $\langle E\text{-List} \rangle \rightarrow \varepsilon$
4.  $\langle T \rangle \rightarrow \langle P \rangle \langle T\text{-List} \rangle$
5.  $\langle T\text{-List} \rangle \rightarrow * \langle P \rangle \langle T\text{-List} \rangle$
6.  $\langle T\text{-List} \rangle \rightarrow \varepsilon$
7.  $\langle P \rangle \rightarrow (\langle E \rangle)$
8.  $\langle P \rangle \rightarrow \text{ident}$

Yes :)