Introduction to Parsing

Lecture 4

Exercise
Question?

How many strings does the following grammar generate?

A → B B
B → C C
C → 1 | 2

○ 7
○ 15
○ 2
○ 8
○ 16
○ 4
How many strings does the following grammar generate?

- A →  B  B
- B →  C  C
- C →  1  |  2

- 7
- 15
- 2
- 8
- **16**
- 4
How many strings does the following grammar generate?

A → B B
B → C C
C → 1 | 2 | ε

- 16
- 31
- 15
- 12
- 64
- 63
- 32
- 11
How many strings does the following grammar generate?

A → B B
B → C C
C → 1 | 2 | ε

Answer!

16
31
15
12
64
63
32
11
Which of the following is a valid derivation of the given grammar?

- \( S \quad \rightarrow \quad aXa \)
- \( X \quad \rightarrow \quad \varepsilon \mid bY \)
- \( Y \quad \rightarrow \quad \varepsilon \mid cXc \mid d \)

- \( S \)
- \( aXa \)
- \( abYa \)
- \( acXca \)
- \( acca \)

- \( S \quad \rightarrow \quad S \)
- \( aa \)

- \( S \quad \rightarrow \quad aXa \)
- \( abYa \)
- \( abcXca \)
- \( abcbYca \)
- \( abcbdca \)

- \( S \quad \rightarrow \quad aXa \)
- \( abYa \)
- \( abcXcda \)
- \( abccda \)
**Answer!**

Which of the following is a valid derivation of the given grammar?

<table>
<thead>
<tr>
<th>Derivation:</th>
</tr>
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<tbody>
<tr>
<td>$S \rightarrow aXa$</td>
</tr>
<tr>
<td>$X \rightarrow \epsilon \mid bY$</td>
</tr>
<tr>
<td>$Y \rightarrow \epsilon \mid cXc \mid d$</td>
</tr>
</tbody>
</table>

- $S \rightarrow aXa \rightarrow abY \rightarrow abcXca \rightarrow abccda \rightarrow abcbdca$

- $S \rightarrow aa$

- $S \rightarrow aXa \rightarrow abYa \rightarrow abcXca \rightarrow abcbYca \rightarrow abcbdca$

- $S \rightarrow aXa \rightarrow acca$

- $S \rightarrow abYa \rightarrow acXca$

- $S \rightarrow abYa \rightarrow acXca$
Which of the following is a valid parse tree for the given grammar?

\[
S \rightarrow aXa \\
X \rightarrow \varepsilon \mid bY \\
Y \rightarrow \varepsilon \mid cXc \mid d
\]
Which of the following is a valid parse tree for the given grammar?

- **S → aXa**
- **X → ε | bY**
- **Y → ε | cXc | d**

Diagram options:
1. ![Diagram 1]
2. ![Diagram 2]
3. ![Diagram 3]
4. ![Diagram 4]
Question?

Choose the grammar that correctly eliminates left recursion from the given grammar: 

\[ E \rightarrow E + T \mid T \]
\[ T \rightarrow \text{id} \mid (E) \]

\[ E \rightarrow \text{id} \mid (E) \]
\[ T \rightarrow \text{id} \mid (E) \]

\[ E \rightarrow E + \text{id} \mid E + (E) \]
\[ \mid \text{id} \mid (E) \]

\[ E \rightarrow \text{id} \mid (E) \]
\[ T \rightarrow \text{id} \mid (E) \]

\[ E \rightarrow \text{id} + E \mid E + T \mid T \]
\[ T \rightarrow \text{id} \mid (E) \]
Answer!

Choose the grammar that correctly eliminates left recursion from the given grammar:

\[ E \rightarrow E + T \mid T \]
\[ T \rightarrow id \mid (E) \]

\[ E \rightarrow TE' \]
\[ E' \rightarrow + TE' \mid \epsilon \]
\[ T \rightarrow id \mid (E) \]
Question?

Consider the following grammar. Adding which one of the following rules will cause the grammar to be left-recursive? [Choose all that apply]

- D → A
- A → D
- B → C
- D → B
- C → 1 C

S → A
A → B | C
B → (C)
C → B + C | D
D → 1 | 0
Consider the following grammar. Adding which one of the following rules will cause the grammar to be left-recursive? [Choose all that apply]

S → A
A → B | C
B → (C)
C → B + C | D
D → 1 | 0

- D → A
- A → D
- B → C
- D → B
- C → 1 C
Question?

Which of the following grammars are ambiguous?

- \( S \rightarrow SS \mid a \mid b \)
- \( E \rightarrow E + E \mid id \)
- \( S \rightarrow Sa \mid Sb \)
- \( E \rightarrow E' \mid E' + E \)
  \[ E' \rightarrow -E' \mid id \mid (E) \]
Answer!

Which of the following grammars are ambiguous?

- $S \rightarrow SS | a | b$
- $E \rightarrow E + E | id$
- $S \rightarrow Sa | Sb$
- $E \rightarrow E' | E' + E$
  - $E' \rightarrow -E' | id | (E)$
Choose the unambiguous version of the given ambiguous grammar: \( S \rightarrow SS \mid a \mid b \mid \varepsilon \)

- \( S \rightarrow S \mid S' \)
- \( S' \rightarrow a \mid b \)
- \( S \rightarrow Sa \mid Sb \)
Choose the unambiguous version of the given ambiguous grammar: \[ S \rightarrow SS \mid a \mid b \mid \varepsilon \]

- \( S \rightarrow Sa \mid Sb \mid \varepsilon \)
- \( S \rightarrow SS' \)
- \( S' \rightarrow a \mid b \)
- \( S \rightarrow Sa \mid Sb \)
- \( S' \rightarrow a \mid b \)
Question?

Consider the following grammar. How many unique parse trees are there for the string $5 \times 3 + (2 \times 7) + 4$?

- $2$
- $1$
- $7$
- $8$
- $5$
- $4$

$E \rightarrow E \times E \mid E + E \mid (E) \mid \text{int}$
Answer!

Consider the following grammar. How many unique parse trees are there for the string $5 \times 3 + (2 \times 7) + 4$?

- $2$
- $1$
- $7$
- $8$
- $5$
- $4$

$E \rightarrow E \times E \mid E + E \mid (E) \mid \text{int}$