

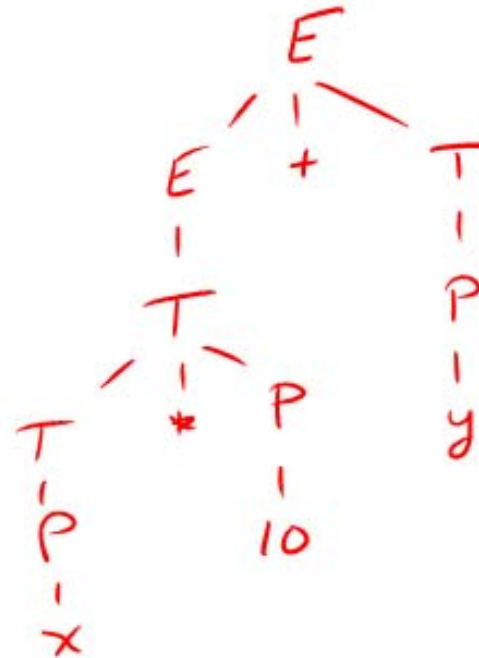
Exercises on cfg notation

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * P \mid P$$

$$P \rightarrow id \mid int \mid (P)$$

- Parse tree for: $x * 10 + y$:



- Give examples of each:

● E-sentence: x T-sentence: x

- E-sentential form that is not a sentence:

$E + T$ $T * P + y$

More exercises on cfg notation

$$E \rightarrow EA$$

$$A \rightarrow \epsilon \mid A + T$$

$$T \rightarrow T(*P)^*$$

$$P \rightarrow id \mid int \mid (P)$$

- Transform this grammar to remove the Kleene star.

$$T \rightarrow TB$$

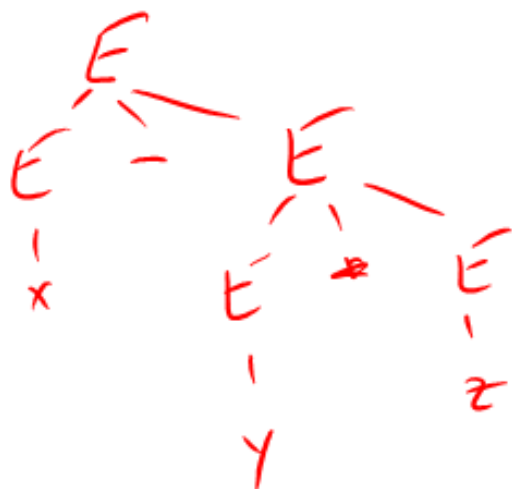
$$B \rightarrow B * P \mid \epsilon$$

- Show that both $E+T$ and $EA+T$ are sentential forms:

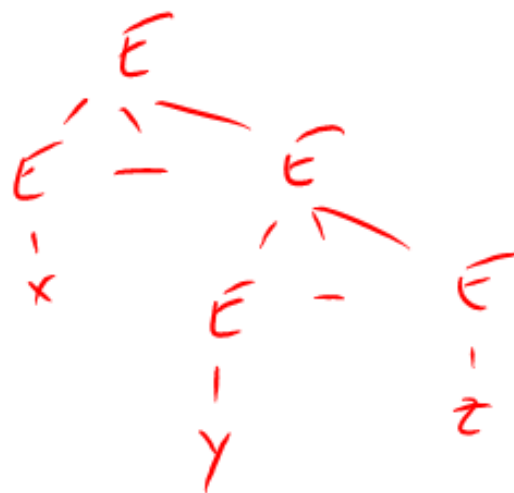


● $G_A: E \rightarrow \text{id} \mid E - E \mid E * E$

● $x - y * z$



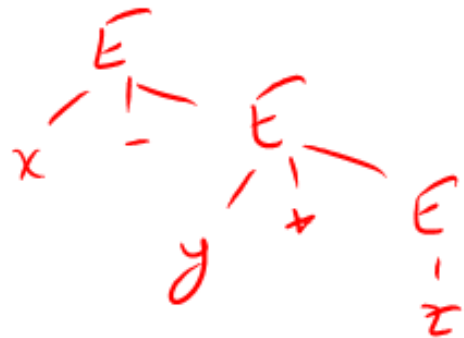
$x - y - z$



● Ambiguous? *yes* Precedence? *No* Associativity? *None*

● $G_B: E \rightarrow \text{id} \mid \text{id} - E \mid \text{id} * E$

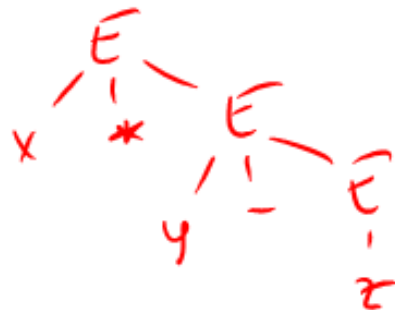
● $x - y * z$



$x - y * z - w$



● $x * y - z$



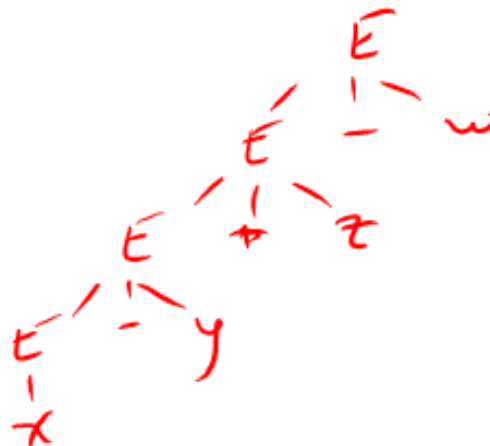
● Ambiguous? *No* Precedence? *No* Associativity? *Right*

● $G_C: E \rightarrow \text{id} \mid E - \text{id} \mid E * \text{id}$

● $x - y * z$



$x - y * z - w$



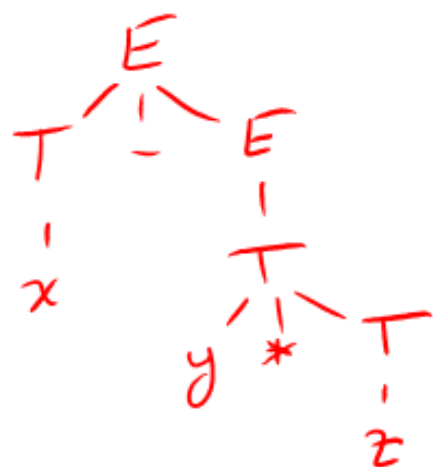
● $x * y - z$



● Ambiguous? *No* Precedence? *No* Associativity? *Left*

● $G_D: E \rightarrow T - E \mid T$
 $T \rightarrow \text{id} \mid \text{id} * T$

● $x - y * z$



$x * y - z$



$x - y - z$



● Ambiguous? *No* Precedence? *yes* Associativity? *Right*

● $G_E: E \rightarrow E - T \mid T$
 $T \rightarrow \text{id} \mid T * \text{id}$

● $x - y * z$



$x * y - z$



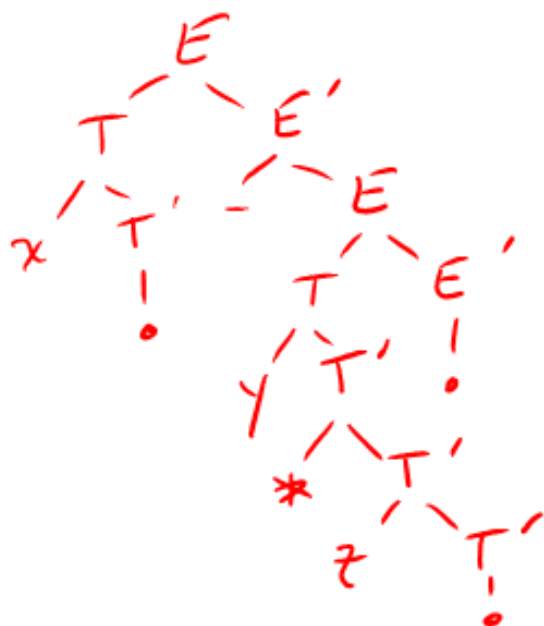
$x - y - z$



● Ambiguous? *No* Precedence? *Yes* Associativity? *Left*

- $G_F: E \rightarrow T E'$
 $E' \rightarrow \epsilon \mid - E$
 $T \rightarrow \text{id } T'$
 $T' \rightarrow \epsilon \mid * T$

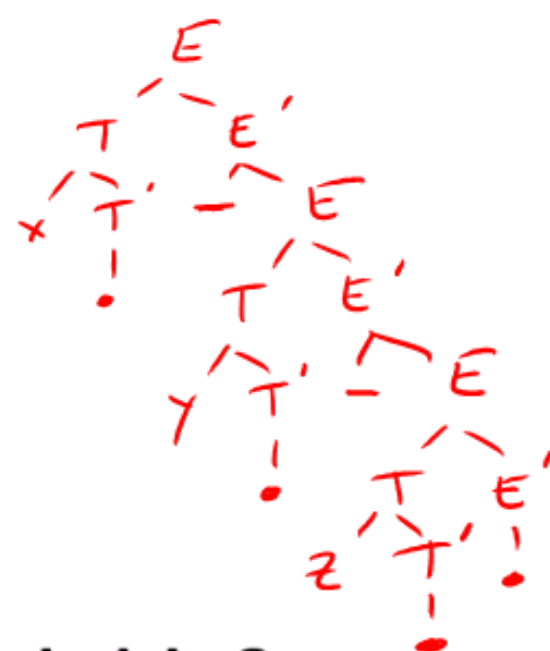
• $x - y * z$



$x * y - z$



$x - y - z$



• Ambiguous?

No

Precedence?

yes

Associativity?

Right