

1. input string: $(1+2+(3+4))+5$
 Grammar: $S \rightarrow E+S \mid E \quad E \rightarrow \text{numbrt} \mid (S)$

S

$S \rightarrow E+S$

$S \rightarrow (S)+S$

$S \rightarrow (E+S)+S$

$S \rightarrow (\text{numbrt}+E)+S$

$S \rightarrow (\text{numbrt}+\text{numbrt})+S$

$S \rightarrow (\text{numbrt}+\text{numbrt}+(S))+S$

$S \rightarrow (\text{numbrt}+\text{numbrt}+(E+E))+S$

$S \rightarrow (\text{numbrt}+\text{numbrt}+(\text{numbrt}+\text{numbrt}))+S$

$S \rightarrow (\text{numbrt}+\text{numbrt}+(\text{numbrt}+\text{numbrt}))+E$

$S \rightarrow (\text{numbrt}+\text{numbrt}+(\text{numbrt}+\text{numbrt}))+\text{numbrt}$

2. input string: $1+(2+- (3+4))+5$
 Grammar: $S \rightarrow E+S \mid E \quad E \rightarrow \text{numbrt} \mid -(S)$

S

$S \rightarrow E+S$

$S \rightarrow \text{numbrt}+S$

$S \rightarrow \text{numbrt}+E+S$

$S \rightarrow \text{numbrt}+\text{numbrt}+S$

$S \rightarrow \text{numbrt}+\text{numbrt}+-(S)$

$S \rightarrow \text{numbrt}+\text{numbrt}+-(E+E)$

$S \rightarrow \text{numbrt}+\text{numbrt}+-(\text{numbrt}+\text{numbrt})$

$S \rightarrow \text{numbrt}+\text{numbrt}+-(\text{numbrt}+\text{numbrt})+\text{numbrt}$

3. Remove ambiguity: $S \rightarrow S+S \mid S-S \mid S*S \mid S/S \mid -S \mid S^S \mid \text{num}$

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

$T \rightarrow T * F \mid T / F \mid F$

$F \rightarrow -F \mid P$

$P \rightarrow P^F \mid \text{num} \mid (E)$