

# LL(1) Grammar Problems

# Left Recursion

Left recursion

$E \rightarrow E + T$

$E \rightarrow T$

replace with

$E \rightarrow E_1 \text{ETail}$

$E_1 \rightarrow T$

$\text{ETail} \rightarrow + T \text{ETail}$

$\text{ETail} \rightarrow \epsilon$

in general

replace

$A \rightarrow A\alpha, A \rightarrow B, \dots, A \rightarrow \zeta$

with

$A \rightarrow NT, N \rightarrow B, \dots, N \rightarrow \zeta,$

$T \rightarrow \alpha T, T \rightarrow \epsilon$  where  $N$  and  $T$  are new nonterminals

# Common Prefix

Common prefixes

$\langle \text{stmt} \rangle \rightarrow \text{if } \langle \text{expr} \rangle \text{ then } \langle \text{stmt list} \rangle \text{ end if;}$

$\langle \text{stmt} \rangle \rightarrow \text{if } \langle \text{expr} \rangle \text{ then } \langle \text{stmt list} \rangle \text{ else } \langle \text{stmt list} \rangle \text{ end if;}$

replace with

$\langle \text{stmt} \rangle \rightarrow \text{if } \langle \text{expr} \rangle \text{ then } \langle \text{stmt list} \rangle \langle \text{if suffix} \rangle$

$\langle \text{if suffix} \rangle \rightarrow \text{end if;}$

$\langle \text{if suffix} \rangle \rightarrow \text{else } \langle \text{stmt list} \rangle \text{ end if;}$

in general

replace

$A \rightarrow \alpha\beta, \dots, A \rightarrow \alpha\zeta$

with

$A \rightarrow \alpha N, N \rightarrow \beta, \dots, N \rightarrow \zeta$  where  $N$  is a new nonterminal