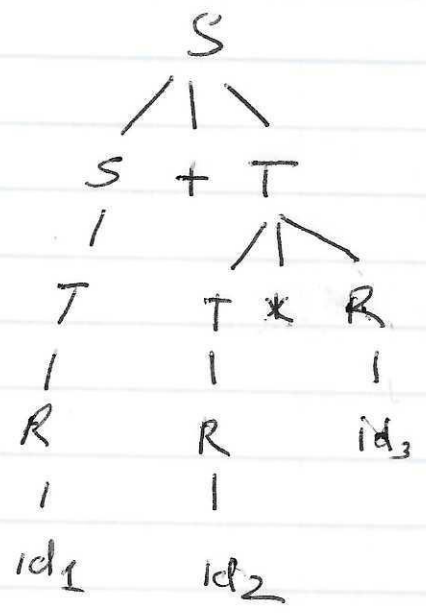


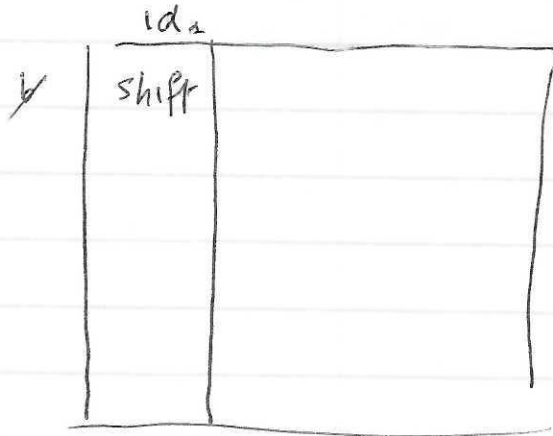
Notes 7.0  
Bottom up Parse Tree



# Notes 7.1

## Shift reduce example

Left stack top how many possibilities 7  
Right stack 5



## Erasing Productions

Consider grammar  $(\lambda \notin L)$

$$S \rightarrow AS$$

$$S \rightarrow B$$

$$A \rightarrow aBC$$

$$B \rightarrow bB$$

$$B \rightarrow \lambda$$

$$C \rightarrow cC$$

$$C \rightarrow \lambda$$

$$A \rightarrow a$$

$$A \rightarrow aB$$

$$A \rightarrow aC$$

$$A \rightarrow aB\epsilon$$

Note  $A \xrightarrow{G}^* W \Rightarrow A \xrightarrow{\hat{G}}^* W$

Also

$$A \xrightarrow{\hat{G}}^* W \Rightarrow A \xrightarrow{G}^* W$$

easy  
just  
erase

→ Consider the first step of the derivation  
Followed by an erasing

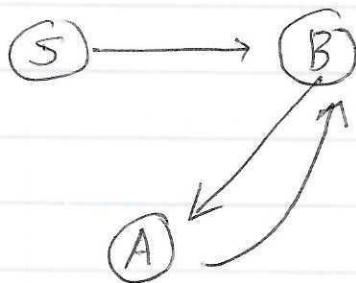
Unit Productions Related

(1) eliminate  $A \rightarrow A$  productions. (not needed)

Create a dependence graph for set of variables ~~rules~~  $A \rightarrow B$  where  $A \neq B$

$S \rightarrow Aa \mid B$      $B \rightarrow A \mid bb$      $A \rightarrow a \mid bc \mid B$

Dependency graph:



From graph we find  $S \overset{*}{\Rightarrow} B$ ,  $S \overset{*}{\Rightarrow} A$   
 $B \overset{*}{\Rightarrow} A$      $A \overset{*}{\Rightarrow} B$

Add non unit productions

$\left\{ \begin{array}{l} S \rightarrow Aa \\ B \rightarrow bb \\ A \rightarrow a \mid bc \end{array} \right.$

if  $X \overset{*}{\Rightarrow} Y$ , add all production  $X \rightarrow y_i$  where  $Y \rightarrow y_i$  &  $y_i$  is a nonunit production

add these  $\left\{ \begin{array}{l} S \rightarrow bb \quad B \rightarrow a \mid bc \quad A \rightarrow bb \\ S \rightarrow a \mid bc \end{array} \right.$

# Example: Eliminating Useless Productions

$S \rightarrow ACH \mid BB$   
 $A \rightarrow aA \mid aF$   
 $B \rightarrow cFH \mid b$   
 $C \rightarrow aC \mid DH$   
 $D \rightarrow aD \mid BD \mid Ca$   
 $F \rightarrow bB \mid b$   
 $H \rightarrow dH \mid d$

Lemma 1 (Useless because cannot create a Terminal string)

$\hat{V} = \emptyset$ , add B, add F, add H.  $\hat{V} = \{B, F, H\}$

second round: add S, add A,  $\hat{V} = \{B, F, H, S, A\}$

third round: Done. Include only productions with terminals and  $\hat{V}$ .

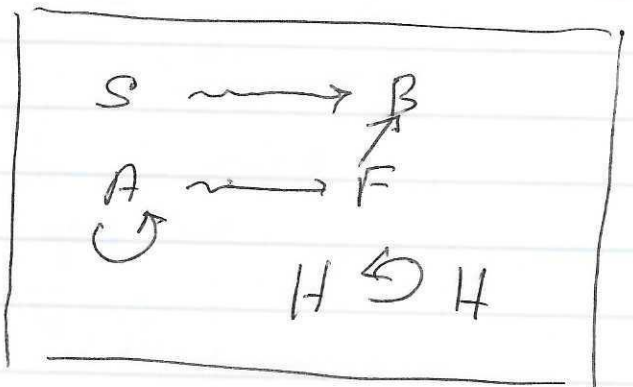
$T \cup \hat{V}$ . New Set:

$S \rightarrow BB$   
 $A \rightarrow aA \mid aF$   
 $B \rightarrow b$   
 $F \rightarrow bB \mid b$   
 $H \rightarrow dH \mid d$

Lemma 2. Dependency Graph:

$\hat{V}$  is only  $\{B, F\}$ .

only productions from above left are:



$S \rightarrow BB$   
 $B \rightarrow b$

DONE!