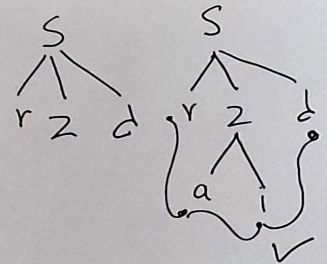
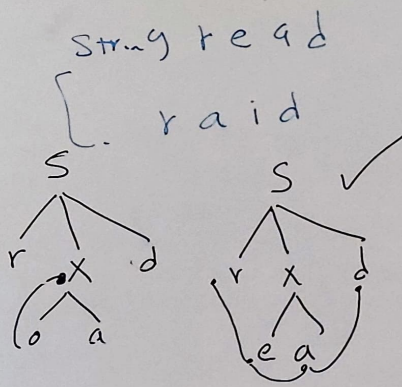
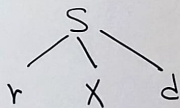


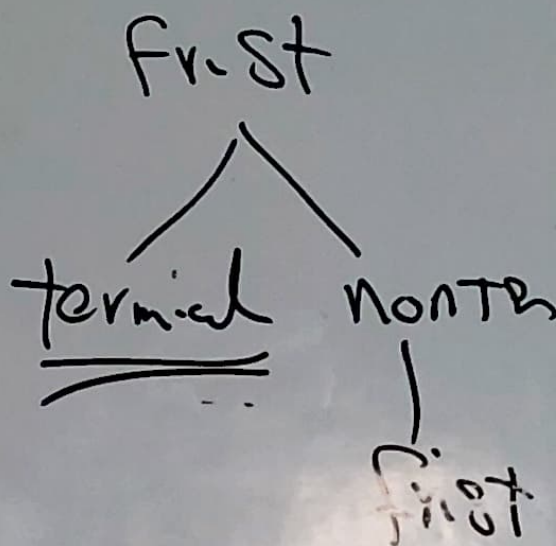
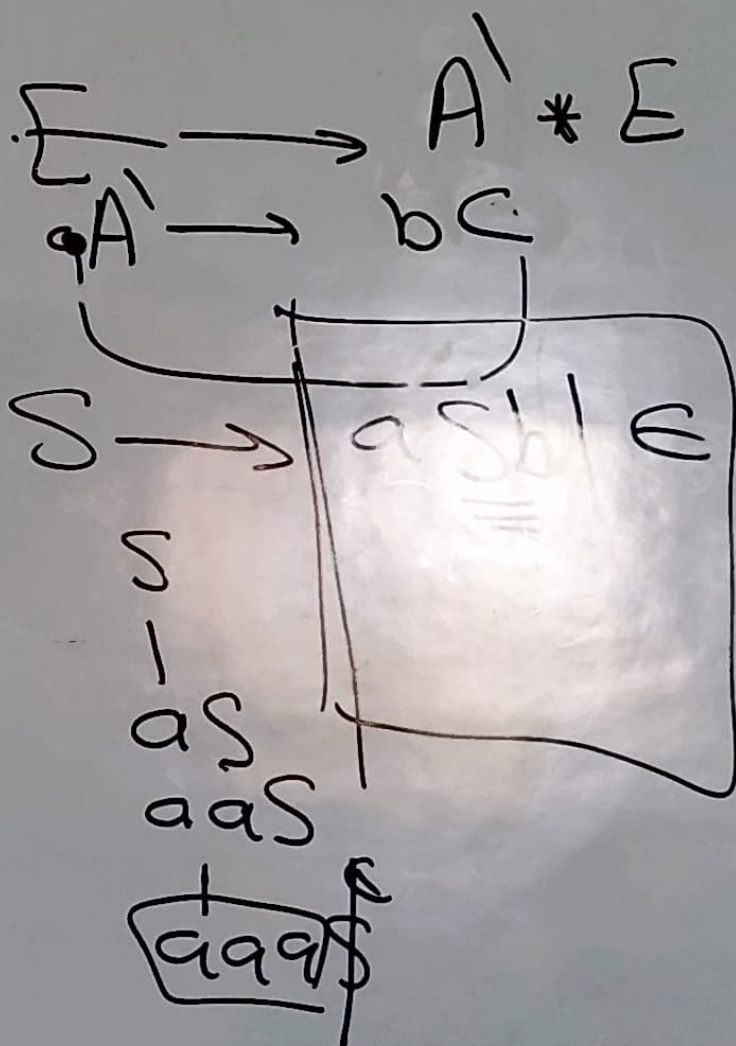
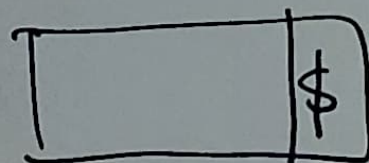
① Back tracking

$S \rightarrow rXd | rZd$
 $X \rightarrow oa | ea$
 $Z \rightarrow ai$

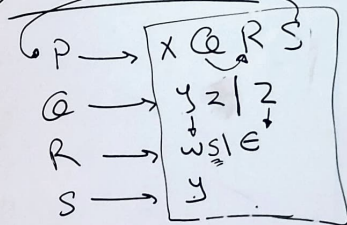


LL(1)

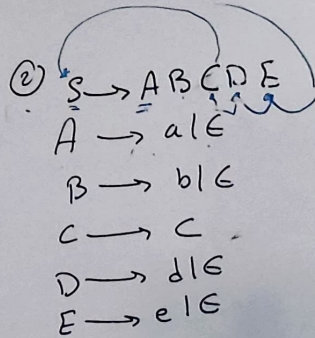
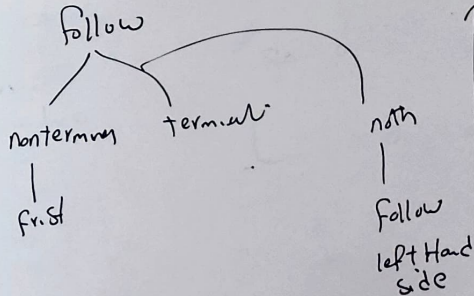
- ① Eliminate left Recursion
- ② first & follow
- ③ Parse table
- ④ Parse tree



① First & Follow



	First	Follow
P	{x}	{}
Q	{y, z}	{w, y}
R	{w, ε}	{y}
S	{y}	{}



Nonterminal	first	Follow
S	{a, ε}	{}
A	{a, ε}	{b, c}
B	{b, ε}	{c}
C	{c}	{d, e, \$}
D	{d, ε}	{e, \$}
E	{e, ε}	{}

$$\begin{aligned} \textcircled{3} \quad S &\rightarrow Bb | c\dot{d} \\ B &\rightarrow aB | \epsilon \\ C &\rightarrow cC | \epsilon \end{aligned}$$

	First	Follow
S	{a, ϵ , c}	{ \$ }
B	{a, ϵ }	{ b }
C	{ c, ϵ }	{ d }

② left Recursion

$$\underline{P} \rightarrow \underline{P} \boxed{+Q} \mid \underline{Q} \mid \underline{B}$$

$$\underline{A} \rightarrow \underline{A} \alpha \mid \underline{B}$$

$$A \rightarrow BA'$$

$$A' \rightarrow \alpha A' \mid \epsilon$$

$$P \rightarrow QP'$$

$$P' \rightarrow +Q P' \mid \epsilon$$

$$\textcircled{2} \quad \underline{S} \rightarrow \underline{S} \alpha \underline{S} \mid \underline{S} \mid \underline{0} \mid \underline{B}$$

$$\textcircled{A} \rightarrow \textcircled{A} \alpha \mid \textcircled{B}$$

$$S \rightarrow 0 \mid S'$$

$$\underline{S'} \rightarrow 0 \underline{S'} \mid \underline{S'} \mid \epsilon$$

③

$$A \rightarrow (B) \mid b$$

$$\underline{B} \rightarrow \underline{B} \alpha \underline{A} \mid \underline{A}$$

$$B \rightarrow AB'$$

$$B' \rightarrow XAB' \mid \epsilon$$

$$S \rightarrow (L) | a | b$$

$$\underline{L} \rightarrow \underline{L}, \underline{s} | \underline{S}$$

$$L \rightarrow S L'$$

$$L' \rightarrow , S L' | \epsilon$$

$$S \rightarrow \underline{a}x | \underline{a}w | \underline{a}z$$

$$S \rightarrow a s'$$

$$S \rightarrow x | w | z$$

$$S \rightarrow i \underline{E} \underline{t} \underline{s} | i \underline{E} \underline{t} \underline{s} \underline{e} S | a$$

$$E \rightarrow C$$

$$A \rightarrow (a) A'$$

$$A' \rightarrow \alpha_1 | \alpha_2 | \alpha_3$$

$$S \rightarrow i E t s S' | a$$

$$S' \rightarrow e s | \epsilon$$

$$E \rightarrow C$$

$$A \rightarrow \underline{a}AB \mid \underline{a}Bc \mid \underline{a}Ac$$

$$A \rightarrow aA'$$

$$A' \rightarrow AB \mid BC \mid AC$$

$$A' \rightarrow AD \mid BC$$

$$D \rightarrow B \mid c$$

$$S \rightarrow \underline{bSS}aaS \mid \underline{bSS}a Sb \mid \underline{bSb}la$$

$$S \rightarrow bsS' \mid a$$

$$S' \rightarrow \underline{sa}(aS) \mid \underline{sa}(sb) \mid b$$

$$S' \rightarrow saD \mid b$$

$$D \rightarrow as \mid sb$$

$$S \rightarrow \underline{bSS}aS \mid \underline{bSb}la$$

$$S' \rightarrow as \mid sb$$

$$S \rightarrow bsD \mid a$$

$$D \rightarrow sas' \mid b$$

$$\begin{aligned}
 E &\rightarrow E + \underline{T} \mid \underline{T} \\
 T &\rightarrow \underline{T} * \underline{f} \mid \underline{f} \\
 f &\rightarrow - E \mid (E) \mid id
 \end{aligned}$$

① Eliminate Left Recursion

$$\begin{aligned}
 E &\rightarrow T E' \\
 E' &\rightarrow + T \mid \epsilon \\
 T &\rightarrow f T' \\
 T' &\rightarrow * f \mid \epsilon \\
 f &\rightarrow - E \mid (E) \mid id
 \end{aligned}$$

② First & Follow

	First	Follow
E	{(, (id)}	{\$,)}
E'	{+, ε}	{\$,)}
T	{(, (id)}	{+, \$,)}
T'	{*, ε}	{+, \$,)}
f	{-, (, id}	{*, +, \$,)}

string id + id * id

\$	*	F	*	id	\$	POP *
\$	F			id	\$	F → id
\$	id				\$	POP id
\$					\$	

left
most
Div

stack	id + id * id	action
\$ E	id + id * id \$	
\$ TE'	id + id * id \$	E → TE'
\$ FT'E'	id + id * id \$	T → FT'
\$ <u>id</u> T'E'	<u>id</u> + id * id \$	F → id
\$ T'E'	POP id	
\$ E'	+ id * id \$	T' → E
\$ T	+ id * id \$	E → +T
\$ FT'	id * id \$	POP T
\$ id T'	id + id \$	T → id
\$ T'	* id \$	POP id

nonterm	+	id	-	*	()	\$
E		F → TE'	E → TE'	E → TE'			
E'	E' → +T				E' → E	E' → E	
T		T' → FT'	T' → FT'		T' → FT'		
T'	T' → E			T' → *	T' → E	T' → E	
F		F → id	F → E		F → (E)		

