

1. $G_1: S \rightarrow bab \mid bA$
 $A \rightarrow d \mid cA$

- (a) $\text{FIRST}(S) = \{ b \}, \text{FIRST}(A) = \{ d, c \}$
- (b) $\text{FIRST}(bab) = \{ b \}, \text{FIRST}(bA) = \{ b \}$
 $\text{FIRST}(d) = \{ d \}, \text{FIRST}(cA) = \{ c \}$
- (c) Yes, for S
- (d) No
- (e) No

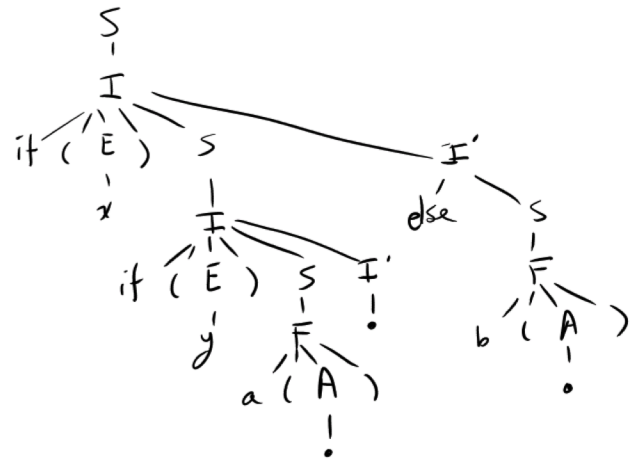
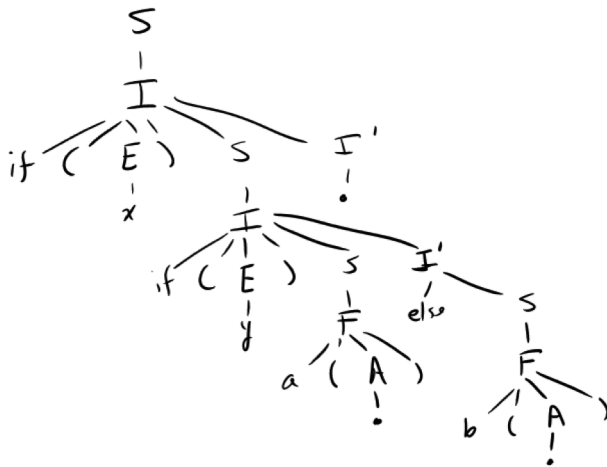
2. $G_2: S \rightarrow bC$
 $C \rightarrow ab \mid A$
 $A \rightarrow d \mid cA$

- (a) $\text{FIRST}(S) = \{ b \}, \text{FIRST}(C) = \{ a, d, c \}, \text{FIRST}(A) = \{ d, c \}$
- (b) $\text{FIRST}(bC) = \{ b \}$
 $\text{FIRST}(ab) = \{ a \}, \text{FIRST}(A) = \{ d, c \}$
 $\text{FIRST}(d) = \{ d \}, \text{FIRST}(cA) = \{ c \}$
- (c) No
- (d) No
- (e) Yes

3. $G_3: S \rightarrow AB$
 $A \rightarrow Ca \mid \epsilon$
 $B \rightarrow BaAC \mid c$
 $C \rightarrow b \mid \epsilon$

- (a) $\text{FIRST}(S) = \{ a, b, c \}, \text{FIRST}(A) = \{ a, b, \bullet \}, \text{FIRST}(B) = \{ c \}, \text{FIRST}(C)$
 $= \{ b, \bullet \}$
- (b) $\text{FIRST}(AB) = \{ b, a, c \}$
 $\text{FIRST}(Ca) = \{ b, a \}, \text{FIRST}(\epsilon) = \{ \bullet \}$
 $\text{FIRST}(BaAC) = \{ c \}, \text{FIRST}(c) = \{ c \}$
 $\text{FIRST}(b) = \{ b \}, \text{FIRST}(\epsilon) = \{ \bullet \}$
- (c) Yes, for B
- (d) Yes
- (e) No

4. G_4 : $S \rightarrow AB$
 $A \rightarrow Ca \mid \epsilon$
 $B \rightarrow cD$
 $D \rightarrow aAcD \mid \epsilon$
 $C \rightarrow b \mid \epsilon$
- (a) $\text{FIRST}(S) = \{ a, b, c \}$, $\text{FIRST}(A) = \{ a, b, \bullet \}$, $\text{FIRST}(B) = \{ c \}$, $\text{FIRST}(D) = \{ a, \bullet \}$, $\text{FIRST}(C) = \{ b, \bullet \}$
- (b) $\text{FIRST}(AB) = \{ b, a, c \}$
 $\text{FIRST}(Ca) = \{ b, a \}$, $\text{FIRST}(\epsilon) = \{ \bullet \}$
 $\text{FIRST}(cD) = \{ c \}$
 $\text{FIRST}(aAcD) = \{ a \}$, $\text{FIRST}(c) = \{ \bullet \}$
 $\text{FIRST}(b) = \{ b \}$, $\text{FIRST}(\epsilon) = \{ \bullet \}$
- (c) No
- (d) No
- (e) Yes. The FOLLOW rule is not violated: A is nullable via rule $A \rightarrow \epsilon$, but $\text{FIRST}(Ca)$ does not intersect with $\text{FOLLOW}(A)$, which is $\{ c \}$; D is nullable, but $\text{FIRST}(aAcD)$ does not intersect with $\text{FOLLOW}(D)$, which is $\{ \text{eof} \}$; C is nullable, but $\text{FIRST}(b)$ does not intersect with $\text{FOLLOW}(C)$, which is $\{ a \}$.
5. $S \rightarrow F \mid I$
 $F \rightarrow \text{IDENT } (A)$
 $I \rightarrow \text{if } (E) S I'$
 $I' \rightarrow \text{else } S \mid \epsilon$
 $E \rightarrow \text{IDENT}$
 $A \rightarrow \text{IDENT } B \mid \epsilon$
 $B \rightarrow , A \mid \epsilon$
- 6.



7. $L \rightarrow E L'$
 $L' \rightarrow ; L \mid \epsilon$
 $E \rightarrow ID \mid INT$

type token = ID of string | INT of int | SEMIC | EOF

exception SyntaxError

let rec parseL toklis = parseL' (parseE toklis)

and parseL' toklis = if hd toklis = SEMIC
then parseL (tl toklis)
else toklis

and parseE toklis = match toklis with
ID _::t -> t
| INT _::t -> t
| _ -> raise SyntaxError ;;