

$$S_2 \quad \left[\begin{array}{l} E \rightarrow E+, E, 0 \\ E \rightarrow .E + E, 2 \\ E \rightarrow .m, 2 \end{array} \right]$$

$w_2 = '+'$

$$S_3 \quad \left[\begin{array}{l} E \rightarrow m, 2 \\ E \rightarrow E + E., 0 \\ E \rightarrow E. + E, 2 \\ (E' \rightarrow E., 0) \\ E \rightarrow E. + E, 0 \end{array} \right]$$

$w_3 = 'm'$

METODE DE ANALIZĂ BOTTOM-UP

$$S \rightarrow aAb$$

$$A \rightarrow bAb$$

$$B \rightarrow bba$$

$$w = abba$$

} d - deplasare
r - reducere

$$\begin{aligned} abbba &\xrightarrow{d} a|bbba \xrightarrow{d} ab|bba \xrightarrow{r} aAb|bba \\ &\xrightarrow{d} aAb|b|a \xrightarrow{r} aAA|b|a \xrightarrow{d} aAAAb|a \\ &\xrightarrow{r} aAA|a \dots S \end{aligned}$$

19. martie 2019

Seminar 3

Fie $G = (N, \Sigma, S, P)$ f.i.c. Să se construiască un translator următor \bar{T}_G . Productie numerotate $1_1, \dots, |P|$.

$$\bar{\delta}(\bar{T}_G) = \{ (\omega, \pi) \mid \omega \in L(G), S \xrightarrow[\pi]{\delta} \omega \}$$

$$\bar{T}_G = (\{g\}, \Sigma, \{1_1, \dots, |P|\}, N \cup \Sigma, \delta, g, S, \emptyset)$$

lucrăm cu
vidarea stiviei
nu cu stivii fin.

} $(g, w, S, \lambda) \leftarrow$

$$\delta(g, \lambda, A) = \{ (g, \alpha, \lambda) \mid j: A \rightarrow \alpha \}$$

$$\delta(g, a, \lambda) = \{ (g, \lambda, \lambda) \}, \forall a \in \Sigma$$

EX 1) $G: S \rightarrow aBbS1bSaS1\lambda$

$$L(G) = \{ w \in \{a, b\}^* \mid |w|_a = |w|_b \}$$

$\lambda, S \mid aSbS, 1$
 ↘ (2) $\lambda, S \mid bSaS, 2$
 $\lambda, S \mid \lambda, 3$
 $a, a \mid \lambda, \lambda$
 $b, b \mid \lambda, \lambda$
 $(g, abba, S, \lambda) \vdash (g, abba, aSbS, 1) \vdash (g, bba, SbS, 1)$
 $\vdash (g, bba, bS, 13) \vdash (g, ba, S, 13) \vdash (g, ba, bSaS,$
 $132) \vdash (g, a, SaS, 132) \vdash (g, a, aS, 1323) \vdash$
 $\vdash (g, \lambda, S, 1323) \vdash (g, \lambda, \lambda, 1323)$

Ex 2: $G: S \rightarrow aSBlaAc$

$A \rightarrow bAc | \lambda$

$B \rightarrow cBc | a$

a) Calculated First₃(BAA) $\xrightarrow{\text{ccBccAA}} \underline{\text{cccBcccAA}}$ (stop)
 $\xrightarrow{\text{ccA--}} \underline{\text{cca--}}$ (stop)
 $\xrightarrow{\text{cBcAA}} \underline{\text{cBcAA}}$ (stop)
 $\xrightarrow{\text{BAA}} \underline{\text{BAA}}$ (stop)
 $\xrightarrow{\text{aAA}} \underline{\text{abAcA}}$ (stop)
 $\xrightarrow{\text{abAA}} \underline{\text{abbAccA}}$ (stop)
 $\xrightarrow{\text{aA}} \underline{\text{abAc}}$ (stop)
 $\xrightarrow{\text{abAA}} \underline{\text{abbAc}}$ (stop)
 $\xrightarrow{\text{aA}} \underline{\text{abc}}$ (stop)

First₃(BAA) = { $\overbrace{\text{ccc, cca, cac}}^a, \text{abb, abc, a} \}$

b) Parser 2-predictive pt. G ou alg. pt. gram. LL(k) dari

$G': S' \rightarrow S\$$
 $S \rightarrow aSB | a^2Ac$
 $A \rightarrow b^3C | \lambda$
 $B \rightarrow a^5B | a^6$

Follow₂

	X	
S	\$, cc, ca, a\$	X
A	a\$, cc, ca	ac, aa
B	\$, cc, ca, a\$, c\$	ac, aa

$$S \rightarrow aSB$$

$$\text{Follow}'_2(S) \doteq \text{First}'_2(B \cdot \text{Follow}'_2(S)) = \{c, c, aa, a\$ \}$$

$$\text{Follow}'_2(B) \doteq \text{First}'_2(\lambda \cdot \text{Follow}'_2(S)) = \text{Follow}'_2(S) \quad \text{(*)}$$

$$S \rightarrow aAc$$

$$\text{Follow}'_2(A) \doteq \text{First}'_2(c \cdot \text{Follow}'_2(S)) = \{c\$, cc, ca \}$$

$$A \rightarrow bAc$$

$$\text{Follow}'_2(A) \doteq \text{First}'_2(c \cdot \text{Follow}'_2(A)) = \{cc \}$$

$$B \rightarrow cBc$$

$$\text{Follow}'_2(B) \doteq \text{First}'_2(c \cdot \text{Follow}'_2(B)) = \{c\$, cc, ca \}$$

- II.
- se adauga $\{ac, aa\}$ la $\text{Follow}'_2(S)$, pt. $S \rightarrow aSB$
 - idem la $\text{Follow}'_2(B)$ pt. $aa \quad \star$

$$1: S \rightarrow aSB$$

$$\text{First}'_2(aSB \cdot \text{Follow}'_2(S)) = \{aa\}$$

$$2: S \rightarrow aAc$$

$$\text{First}'_2(aAc \cdot \text{Follow}'_2(S)) = \{ab, ac\}$$

$$3: A \rightarrow bAc$$

$$\text{First}'_2(bAc \cdot \text{Follow}'_2(A)) = \{bb, bc\}$$

$$4: A \rightarrow \lambda$$

$$\text{First}'_2(\lambda \cdot \text{Follow}'_2(A)) = \overbrace{\text{Follow}'_2(A)}^{\text{First}'_2} - \{c\$, cc, ca\}$$

$$5: B \rightarrow cBc$$

$$\text{First}'_2(cBc \cdot \text{Follow}'_2(B)) = \{cc, ca\}$$

$$6: B \rightarrow \lambda$$

$$\text{First}'_2(\lambda \cdot \text{Follow}'_2(B)) = \{ab, ac, aa\}$$

TABELUL DE ANALIZĂ SINTACTICĂ:

M	S	A	B
aa	(a ³ b, 1)	err	(a, 6)
ab	(aAc, 2)	err	err
ac	(aAc, 2)	err	(a, 6)
a\$	err	err	(a, 6)
bb	(bAC, 2)	err	err
bc	err	(bAC, 3)	err
ca	err	(\lambda, 4)	(cbc, 5)
cc	err	(\lambda, 4)	(cbc, 5)
c\$	err	(\lambda, 4)	

$M[\$, \$] = \text{accept}$

$M[a, a] = \text{delete}$

$M[\cdot, \cdot] = \text{error}$ in next

Analizare viral: (aabcca \$, 3 \$, λ)

- decorece vite parcurse 2-predictiile → nu sunt în primul 2 caractere

{ de nf. urmări și opțiuni în tabel

$$\begin{aligned}
 & (\text{aabcca } a \$, 3 \$, \lambda) \vdash (\text{aabcca } \$, a \$ b \$, 1) \vdash (\text{abcca}, 3 \$) \\
 & \vdash (\text{abcca } \$, a \$ c \$, 12) \vdash (\text{beca } \$, A c B \$, 12) \vdash \\
 & \vdash (\text{bccat } \$, b A C \$, 123) \vdash (\text{cc } \$, A c c B \$, 123) \vdash \\
 & \vdash (\text{cc } \$, c c B \$, 1234) \vdash (\$, B \$, 1234) \\
 & \vdash (\$, \$, 12346) \vdash (\$, \$, 12346) \vdash \text{accept}
 \end{aligned}$$

{ ! M nu are întării multiple \Rightarrow G este LL(2) dacă

EX: $S \rightarrow AA$

$A \rightarrow aAbA$

$A \rightarrow bAbA$

$A \rightarrow \lambda$

- se extinde gramatica: $S' \rightarrow S$

- analizare: $w = abba$

ALG. EARLEY

{ $S' \rightarrow \cdot S, 0$ în S_0

Scenariu: De $A \rightarrow \alpha \cdot \beta$, $j \in S_i$, $j \leq m-1$

$\alpha_{i+1} = \alpha$, atunci $A \rightarrow \alpha \cdot \beta$, j la S_{i+1}

Hidrocarburii: $A \rightarrow \alpha \cdot B_p, j \in \omega$
 - pt. fiecare $B_j \rightarrow j \in P$ astfel $B_j \rightarrow \beta, i \in \omega$ da S_i
 - in plus, de. $B_j \not\equiv \lambda$, at. astfel $A \rightarrow \alpha \cdot B_j \cdot \beta, j \in \omega$
 Completare: De $A \rightarrow \alpha, j \in \omega$ in $B \rightarrow B \cdot A, j \in \omega$
 * in S_j at. astfel $B \rightarrow B \cdot A, j \in \omega$ da S'_j

$$S_0 \left\{ \begin{array}{l} S' \rightarrow S_0, 0 \\ S \rightarrow . \cdot AA, 0 \\ A \rightarrow . \cdot aAbA, 0 \\ A \rightarrow . \cdot bAaA, 0 \\ A \rightarrow . \cdot \Delta, 0 \\ S \rightarrow A \cdot A, 0 \\ S \rightarrow AA, 0 \\ S' \rightarrow S, 0 \end{array} \right.$$

$$S_1 \left\{ \begin{array}{l} A \rightarrow a \cdot AbA, 0 \\ A \rightarrow . \cdot aAbA, 1 \\ A \rightarrow . \cdot bAaA, 1 \\ A \rightarrow . \cdot \Delta, 1 \\ A \rightarrow QA \cdot ba, 0 \end{array} \right.$$

$$S_2 \left\{ \begin{array}{l} A \rightarrow b \cdot AaA, 1 \\ A \rightarrow aAb, A, 0 \\ A \rightarrow . \cdot aAbA, 2 \\ A \rightarrow . \cdot bAaA, 2 \\ A \rightarrow . \cdot \Delta, 2 \\ A \rightarrow bA \cdot aA, 1 \\ A \rightarrow aAbA, , 0 \\ S \rightarrow A \cdot A, 0 \\ S \rightarrow AA, 0 \\ S' \rightarrow S, 0 \end{array} \right.$$

$w \in L(G) \Leftrightarrow S^* \rightarrow S_0, 0 \in S_m$

$|w| = m$

25. martie 2019

Curs 6

GRAMATICOI SI UIMITATE DE TIP LR (left-right)

- virul analizat este parcurs stanga-dreapta
- cele alt. derivari drepte pt. oprurile analizate

DEF: Fie $G = (N, \Sigma, S, P)$ p.i.c. Spunem că G este de tip $LR(k)$, $k \geq 0$ dacă pt. $\forall i \geq 2$ derivările drepte:

$$S \xrightarrow{*} \alpha Aw \Rightarrow \alpha \beta w \quad (w \in \Sigma^*)$$

$$S \xrightarrow{*} \gamma \beta A \alpha \Rightarrow \alpha \beta y \quad (\beta \rightarrow \gamma \in P, \gamma \beta \neq \alpha \beta, y \in \Sigma^*)$$

a.i. $First_k(w) = First_k(y)$, adică

$$\alpha = \gamma, A = \beta \Rightarrow \gamma = y$$

Prop 1: Dacă G este de tip $LR(k)$, atunci G este neambiguă.

Dem: P.p. că $G = (N, \Sigma, S, P)$ este $LR(k)$ și este ambigă

At. $\exists z \in L(G)$ cu 2 derir. drepte distincte:

$$S \xrightarrow{*} \alpha Aw \Rightarrow \alpha \beta w \xrightarrow{*} z$$

$$S \xrightarrow{*} \gamma \beta y \Rightarrow \gamma \beta y \xrightarrow{*} z, \gamma \beta y = \alpha \beta w \text{ și}$$

$$A \rightarrow \beta + B \rightarrow \gamma, A \rightarrow \beta, B \rightarrow \gamma \in P$$

Dacă G este $LR(k)$ și vom avea $\gamma \beta y = \alpha \beta w \Rightarrow \alpha = \gamma$,

$$A = B, y = w$$

Din $\gamma \beta y = \alpha \beta w \Rightarrow \beta = \gamma$, deci $A \rightarrow \beta = B \rightarrow \gamma \cancel{\Rightarrow}$

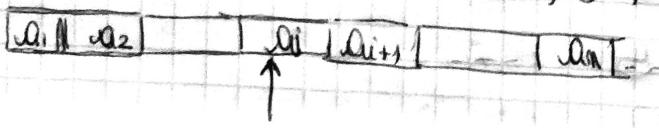
Prop 2: Orice gram. de tip $LR(k)$, $k \geq 2$ este echiv. cu o gram de tip $LR(1)$.

ALGORITM DE ANALIZĂ SINTRACICĂ DE TIP LR

$G = (N, \Sigma, S, P)$ p.i.c.

$G' = (N \cup \{S'\}, \Sigma \cup \{\$\}, S', P \cup \{S' \rightarrow \$\})$

Input



$$w_1, \dots, w_n \in \Sigma^*$$

$$x_1, \dots, x_m \in \Sigma \cup N$$

$$S_0, S_1, \dots, S_m - stările$$

unei AFD care recunoaște