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اصول طراحے کامپایٹر

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مسئله ی 1 :

برای هریک از گرامرهای زیر :

الف) در صورت لزوم، فاکتورگیری از چپ یا رفع چپ گردی را انجام دهید، سپس برای گرامر جدید (پس از رفع چپ گردی و فاکتورگیری از چپ)

ب) تابع First را برای همه پایانه ها و غیرپایانه ها و بدنه قواعد و

ج) تابع Follow را برای همه غیرپایانه ها بنویسید.

1. $S \rightarrow SS+ \mid SS^* \mid a$

○ $S \rightarrow SSZ \mid a$

○ $Z \rightarrow + \mid *$

▪ $S \rightarrow SSZ \mid A$

▪ $S \rightarrow Aa'$

▪ $A' \rightarrow SZA' \mid \varepsilon$

▪ $A' \rightarrow aA'ZA' \mid \varepsilon$

▪ $Z \rightarrow + \mid *$

• $S \rightarrow Aa'$

• $A' \rightarrow aA'ZA' \mid \varepsilon$

• $Z \rightarrow + \mid *$

Firsts :

- $\text{First}(S) = \{a\}$
- $\text{First}(A') = \{a, \varepsilon\}$
- $\text{First}(Z) = \{+, *\}$
- $\text{First}(aA') = \{a\}$
- $\text{First}(aA'ZA') = \{a\}$
- $\text{First}(+) = \{+\}$
- $\text{First}(*) = \{*\}$
- $\text{First}(\varepsilon) = \{\varepsilon\}$

Follows:

- $\text{Follow}(S) = \{\$ \}$
- $\text{Follow}(A') = \{+, *, \$ \}$
- $\text{Follow}(Z) = \{a\}$

2. $S \rightarrow 0S1 \mid 01$

- $S \rightarrow 0Z$
- $Z \rightarrow S1 \mid 1$
 - $S \rightarrow 0Z$
 - $Z \rightarrow 0Z1 \mid 1$

Firsts:

$\text{First}(S) = \{0\}$

$\text{First}(Z) = \{0,1\}$

$\text{First}(0Z) = \{0\}$

$\text{First}(0Z1) = \{0\}$

$\text{First}(1) = \{1\}$

Follows:

$\text{Follow}(S) = \{1, \$\}$

$\text{Follow}(Z) = \{\$, 1\}$

3. $S \rightarrow S (S) S \mid \lambda$

- $S \rightarrow C$
- $C \rightarrow (S) S C \mid \epsilon$

Firsts:

- $\text{First}(S) = \text{First}(C) = \{ (, \epsilon \}$
- $\text{First}((S)SC) = \{ (\}$
- $\text{First}(\epsilon) = \{ \epsilon \}$

Follows :

- $\text{Follow}(S) = \text{Follow}(C) = \{ (,) , \$ \}$

4. $S \rightarrow +SS \mid * SS \mid a$

Firsts:

$\text{First}(S) = \{+, *, a\}$

$\text{First}(+SS) = \{+\}$

$\text{First}(*SS) = \{*\}$

$\text{First}(a) = \{a\}$

$\text{First}(+) = \{+\}$

$\text{First}(*) = \{*\}$

Follows:

$\text{Follow}(S) = \{\$, a, +, *, \}$

5. $expression \rightarrow expression + term$
 $expression \rightarrow expression - term$
 $expression \rightarrow term$
 $term \rightarrow term * factor$
 $term \rightarrow term / factor$
 $term \rightarrow factor$
 $factor \rightarrow (expression)$
 $factor \rightarrow id$

- $expression \rightarrow expression + term \mid expression - term \mid term$
- $term \rightarrow term * factor \mid term / factor \mid factor$
- $factor \rightarrow expression \mid id$
- $expression \rightarrow termA'$
- $A' \rightarrow AA' \mid \varepsilon$
- $A \rightarrow + term \mid - term$
- $term \rightarrow factorC'$
- $C' \Rightarrow CC' \mid \varepsilon$
- $C \rightarrow *factor \mid /factor$
- $factor \rightarrow (expression) \mid id$

راه حل دوم سوال :

$expression \rightarrow term expression'$
 $expression' \rightarrow + expression \mid - expression \mid \varepsilon$

$term \rightarrow factor term'$
 $term \rightarrow *term \mid /term \mid \varepsilon$

$factor \rightarrow (expression) \mid id$

Firsts :

$First(expression) = First(term) = First(factor) = First(termA') = \{ (, id \}$

$First(A') = First(A) = First(AA') = \{ +, -, \varepsilon \}$

$First(C') = First(C) = \{ \varepsilon, *, / \}$

$First(+term) = \{ + \}$

$First(-term) = \{ - \}$

$First(*factor) = \{ * \}$

$First(/factor) = \{ / \}$

$First((expression)) = \{ (\}$

$First(id) = \{ id \}$

Follows :

Follow(expression) = { }, \$}

Follow(term) = First(A') = { +, - }

Follow(A') = Follow(expression)

Follow(A) = First(A') = { +, - }

Follow(Z') = Follow(term) = Follow(Z) = First(Z') = { *, / }

Follow(factor) = Follow(Z)

6. $A_0 \rightarrow aA_0 \mid bA_0 \mid aA_1$

$A_1 \rightarrow bA_2$

$A_2 \rightarrow bA_3$

$A_3 \rightarrow \lambda$

Firsts :

First(A₀) = { a, b }

First(A₁) = { b }

First(A₂) = { b }

First(A₃) = { λ }

First(a) = { a }

First(b) = { b }

First(aA₀) = { a }

First(bA₀) = { b }

First(aA₁) = { a }

First(bA₂) = { b }

First(bA₃) = { b }

First(λ) = { λ }

Follows:

Follow(A₀) = Follow(A₁) = Follow(A₂) = Follow(A₃) = { \$ }

مسئله ی 2 :

گرامر زیر را در نظر بگیرید :

$S \rightarrow 0 \mid 1 S 2 S 3 \mid 1 A 3$

$A \rightarrow S \mid A S$

1. مجموعه First و Follow را برای تمام غیرپایانه ها و پایانه ها بنویسید :

Firsts:

$\text{First}(S) = \text{First}(A) = \{0,1\}$

$\text{First}(0) = \{0\}$

$\text{First}(1S2S3) = \{1\}$

$\text{First}(1A3) = \{1\}$

$\text{First}(AS) = \{0,1\}$

Follows :

$\text{Follow}(S) = \{0,1,2,3,\$ \}$

$\text{Follow}(A) = \{0,1,3\}$