Technical University of Moldova

Faculty of Computers, Informatics and Microelectronics
Software Engineering and Automation Department

Homework 1

Authors:
FAF203 Student:
Sevcenco Nicolae

Supervisor:
Irina Cojuhari

Chișinău, 2022

Ex1

Present the language L(G) generated by the given grammar $G = (V_n, V_n, S, P)$

- V_n = {S}; V_t = {a}; P = {S → aS, S → ε }

$$L = \{a^n | n \geq 0\} \tag{1}$$

- V_n = {S}; V_t = {a}; P = {S → aS, S → a }

$$L = \{a^n | n \geq 1\} \tag{2}$$

- V_n = {A}; V_t = {0,1}; P = {A → 0A1, A → 01 }

$$L = \{0^n, 1^n | n \geq 1\} \tag{3}$$

Ex2

Identify the grammar for the following languages:

- $L = \{a^n, b^n | n \geq 0\}$

$$V_n = \{S\}; V_t = \{a, b\}; P = \{S \rightarrow \varepsilon, S \rightarrow aSb\} \tag{4}$$

- $L = \{a^n, b^n | n > 0\}$

$$V_n = \{S\}; V_t = \{a, b\}; P = \{S \rightarrow aSb, S \rightarrow ab\} \tag{5}$$

- $L = \{a^n, b^{n+1} | n \geq 1\}$

$$V_n = \{S\}; V_t = \{a, b\}; P = \{S \rightarrow aSb, S \rightarrow abb\} \tag{6}$$

- $L = \{a^n, b^n, c^m, d^m | n > 1, m > 1\}$

$$V_n = \{S, A\}; V_t = \{a, b, c, d\}; P = \{S \rightarrow aSb | aAb; A \rightarrow dAc | dc\} \tag{7}$$

- $L = \{a^n, b^n, c^m, d^m | n \geq 0, m \geq 0\}$

$$V_n = \{S, A\}; V_t = \{a, b, c, d\}; P = \{S \rightarrow aSb | aAb | \varepsilon; A \rightarrow dAc | dc | \varepsilon\} \tag{8}$$

- $L = \{a^n, b^m, c^m, d^n | n > 1, m > 1\}$

$$V_n = \{S, A\}; V_t = \{a, b, c, d\}; P = \{S \rightarrow aSd | aAd; A \rightarrow bAc | bc\} \tag{9}$$

- $L = \{a^m, b^n, c^{m+n} | n \geq 1, m \geq 1\}$

$$V_n = \{S, A, B\}; V_t = \{a, b, c\}; P = \{S \rightarrow AB; A \rightarrow aAc | ac; B \rightarrow bBc | bc\} \tag{10}$$

- $L = \{a^m, b^{m+n}, c^n | n \geq 1, m \geq 1\}$

$$V_n = \{S, A, B\}; V_t = \{a, b, c\}; P = \{S \rightarrow AB; A \rightarrow aAb | ab; B \rightarrow bBc | bc\} \tag{11}$$

Ex3

For the given grammar identify the generated word:

G=(V_n ,V_n , S , P) V_n = {<programm>,<set of afirmation>, <afirmation>, <assigment>,<test>,<variable>,<number>, ¡alpha>};

V_t = {begin, end, succ, pred, while, do, :=, ≠ , ;, (,), 0,1. . . .9, A, B,. . . .Z }

P = {<program> → begin end
<program> → begin <set of afirmation>end
<set of afirmation> → <afirmation>
<set of afirmation> → <set of afirmation><afirmation>
<afirmation> → <assigment>
<afirmation> → while<test>do<afirmation>— <program>
<afirmation> → <program>
<test> → <variable> ≠ <variable>
<assigment> → <variable>:=0
<assigment> → <variable>:=succ(<variable>)
<assigment> → <variable>:=pred(<variable>)
<variable> → <alpha>
<variable> → <variable¿<alpha>
<variable> → <variable><number>
<number> → 0—1—2—3—4—5—6—7—8—9
<alpha> → A—B—. . . —Z }

Solution

<program> → **begin** <set of afirmation > **end** → **begin** <afirmation> **end** → **begin** <assigment> **end** → **begin** <variable> **:=0 end** → **begin** <alpha> **:=0 end** → **begin A:=0 end**

```
begin
   A:=0
end
```

Ex4

Define grammar tha generates the variable identifiers from Java.

$$
\begin{gathered}
V_n = \{<\text{start}>,<\text{next}>\} \\
V_t = \{0,1,2,...,9,\text{A},\text{B},\text{C},...,\text{Z},\text{a},\text{b},\text{c},...,\text{z},\ \$,\ \_\ \} \\
\text{P} = \{\ <\text{start}> \rightarrow \text{A}|\text{B}|...|\text{Z}|\text{a}|\text{b}|...|\text{z}<\text{next}>, \\
<\text{next}> \rightarrow \text{A}|\text{B}|...|\text{Z}|\text{a}|\text{b}|...|\text{z}|0|1|...|9|\$|...<\text{next}>, \\
<\text{next}> \rightarrow \varepsilon\ \}
\end{gathered}
$$

Ex5

Define the grammar that generates all real literals in Java.

$$
\begin{gathered}
V_n = \{<\text{float}>,<\text{decimal}>\} \\
V_t = \{0,1,2,...,9,\text{A},\text{B},\text{C},...,\text{Z},\text{a},\text{b},\text{c},...,\text{z},\ .\ \} \\
\text{P} = \{\ <\text{float}> \rightarrow \text{A}|\text{B}|...|\text{Z}|\text{a}|\text{b}|...|\text{z}<\text{decimal}>, \\
<\text{decimal}> \rightarrow .|\text{A}|\text{B}|...|\text{Z}|\text{a}|\text{b}|...|\text{z}|0|1|...|9|\$|...<\text{decimal}>, \\
<\text{decimal}> \rightarrow \varepsilon\ \}
\end{gathered}
$$

Ex6

Define the grammar that generates the strings that correspond to valid currency amounts. A valid string is either a dollar sign followed by a number which has no leading 0's, and may have a decimal point in which case it must be followed by exactly two decimal digits, OR a one or two-digit amount followed by the cent sign c. The single exception to this rule is that strings which begin with "$0." and are followed by exactly two digits are also acceptable. Thus, $432.63, 1,0.29, 47c, 2c are all accepted, but $021, $4.3, $8.63c, $0.0 are not accepted.

Solution

$$
\begin{gathered}
V_n = \{\ \text{S},\text{A}\ \} \\
V_t = \{\ 0,1,2,...,9,...,\$,\text{c}\} \\
\text{P} = \{ \\
\text{S} \rightarrow \$1|2|...|9\text{A}, \\
\text{S} \rightarrow \text{Dc}, \\
\text{S} \rightarrow \text{DDc}, \\
\text{S} \rightarrow \$0.\text{DD}, \\
\text{A} \rightarrow 0|1|...|9\text{A}, \\
\text{A} \rightarrow .\text{DD}, \\
\text{D} \rightarrow 0|1|...|9\ \}
\end{gathered}
$$