Automata and Language Theory

Chapter 3(Context Free Grammar)

Part 3

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Chapter 3- Context Free Grammar

Example:

Construct a context-free grammar over {a, b} that each word of the language is spelled the same forward and backward.

Solution

$$S \rightarrow aSa/\ bSb / a / b / \lambda$$

Palindrome

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Example:

Write a grammar for the language consisting of strings {*a*, b, c} that have *2n* copies of the letter a followed by m copies of the letter b followed by n+m copies of the letter c . (e.g. *aabcc* , *aaaabccc* , ...)

Solution

$S \rightarrow aaSc / aaAc/A$

$A \rightarrow bAc / \lambda$

Chapter 3- Context Free Grammar

Example :

Let G : *< stmt >* → < assignment >/ *< if-stmt >*
< if-stmt > → *if* (*<cond.>*) *<stmt> / if* (*<cond.>*) *<stmt> else <stmt>*
<cond.> → *<arth.E> <relop> <arth.E>*
< assignment > → *<id> = <arth.E>*
<arth.E> → *<id> / <const.>*
<relop> → < / > / = =
<id> → x / y
<const.> → -1/ 1 / 2/ 0

a) Construct the parse tree and left most derivation of the following string:

if (*x >2*) *y=1*
else if (*x= =2*) *y=0*
else y = -1

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G: *< stmt >* → < assignment >| *< if-stmt >*

< if-stmt > → *if* (*<cond.>*) *<stmt> / if* (*<cond.>*) *<stmt> else <stmt>*

<cond.> → *<arth.E> <relop> <arth.E>*

< assignment > → *<id> = <arth.E>*

<arth.E> → *<id> / <const.>*

<relop> → < | > | = =

<id> → x | y

<const.> → -1| 1 | 2| 0

Solution

< stmt > ⇒ *< if-stmt >*

⇒ *if* (*<cond.>*) *<stmt> else <stmt>*

⇒ *if* (*<arth.E> <relop> <arth.E>*) *<stmt> else <stmt>*

⇒ *if* (*<id>* *<relop> <arth.E>*) *<stmt> else <stmt>*

⇒ *if* (*x* *<relop> <arth.E>*) *<stmt> else <stmt>*

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⇒ *if (x > <arth.E>) <stmt> else <stmt>*

⇒ *if (x > <const.>) <stmt> else <stmt>*

⇒ *if (x > 2) <stmt> else <stmt>*

⇒ *if (x > 2) < assignment > else <stmt>*

⇒ *if (x >2) <id> = <arth.E> else <stmt>*

⇒ *if (x >2) y = <arth.E>else <stmt>*

⇒ *if (x >2) y = <const.>else <stmt>*

⇒ *if (x >2) y = 1 else <stmt>*

⇒ *if (x >2) y = 1 else < if-stmt >*

⇒ *if (x >2) y = 1 else if (<cond.>) <stmt> else <stmt>*

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⇒ *if (x >2) y = 1 else if (<arth.E> <relop> <arth.E>)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (<id> <relop> <arth.E>)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (x <relop> <arth.E>)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (x == <arth.E>)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (x== <const.>)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2)<stmt> else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2) < assignment > else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2) <id> = <arth.E>else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2) y = <arth.E>else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2) y = <const.> else <stmt>*

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⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else <stmt>*

⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else < assignment >*

⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else <id> = <arth.E>*

⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else y = <arth.E>*

⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else y = <const.>*

⇒ *if (x >2) y = 1 else if (x== 2) y = 0 else y = -1*

```
if ( x >2 ) y=1
      else if (x= =2 ) y=0
            else  y = -1
```

Chapter 3- Context Free Grammar

Exercise :

1- Write the context free grammar for the program:

```
Void main ( )
Int A,B, C;
A=B+C;
B =C; }
```

2- Write a context free grammar for the *C++ for statement*