PR 6 TBFO

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Exercise 5.1.1

Design context-free grammar for the following languages.

a) The set $\{0^n 1^n \mid n \geq 1\}$, that is, the set of all strings of one or more 0's followed by an equal number of 1's.

$G = (\{S\}, \{0,1\}, S, P)$
dengan P adalah production rule :
$S \rightarrow 0S1 \mid 01$

b) The set $\{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$, that is, the set of strings of a's followed by b's followed by c's, such that there are either a different number of a's & b's or a different number of b's & c's, or both.

$G = (\{S, A, B, C, D, E\}, \{a, b, c\}, S, P)$
dengan P adalah production rule :

$S \rightarrow AB \mid CD$
$A \rightarrow aA \mid \varepsilon$
$B \rightarrow bBc \mid E \mid cD$
$C \rightarrow aCb \mid E \mid aA$
$D \rightarrow cD \mid \varepsilon$
$E \rightarrow bE \mid b$

c) The set of all strings of a's & b's that are not of the form ww, that is, not equal to any string repeated.

$G = (\{S, T, A, B\}, \{a, b\}, S, P)$
dengan P adalah production rule :

$S \rightarrow AB \mid BA \mid T$
$T \rightarrow aTb \mid bTa \mid aTa \mid bTb \mid a \mid b$
$A \rightarrow aAb \mid bAa \mid aAa \mid bAb \mid a$
$B \rightarrow aBb \mid bBa \mid aBa \mid bBb \mid b$

d) The set of all strings with twice as many 0's as 1's.

$G = (\{S\}, \{0, 1\}, S, P)$
dengan P adalah production rule :
$S \rightarrow \varepsilon \mid SS \mid 00S1 \mid 1S00 \mid 01S0$

Exercise 5.1.2

The following grammar generates the language of regular expression $0^*1(0+1)^*$

$S \rightarrow A1B$

$A \rightarrow 0A \mid \varepsilon$

$B \rightarrow 0B \mid 1B \mid \varepsilon$

Give leftmost & rightmost derivations of the following strings:

a) 00101

LM : $S \rightarrow A1B \rightarrow 0A1B \rightarrow 00A1B \rightarrow 001B \rightarrow 0010B \rightarrow 00101B \rightarrow 00101$

RM : $S \rightarrow A1B \rightarrow A10B \rightarrow A101B \rightarrow A101 \rightarrow 0A101 \rightarrow 00A101 \rightarrow 00101$

b) 1001

LM : $S \rightarrow A1B \rightarrow 1B \rightarrow 10B \rightarrow 100B \rightarrow 1001B \rightarrow 1001$

RM : $S \rightarrow A1B \rightarrow A10B \rightarrow A100B \rightarrow A1001B \rightarrow A1001 \rightarrow 1001$

c) 00011

LM : $S \rightarrow A1B \rightarrow 0A1B \rightarrow 00A1B \rightarrow 000A1B \rightarrow 0001B \rightarrow 00011B \rightarrow 00011$

RM : $S \rightarrow A1B \rightarrow 0A11B \rightarrow A11 \rightarrow 0A11 \rightarrow 00A11 \rightarrow 000A11 \rightarrow 00011$

Exercise 5.4.1

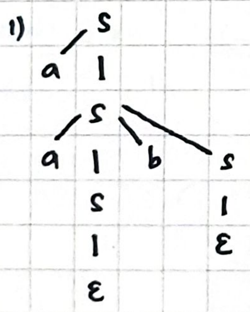
Consider the grammar

$S \rightarrow aS \mid aSbS \mid \varepsilon$

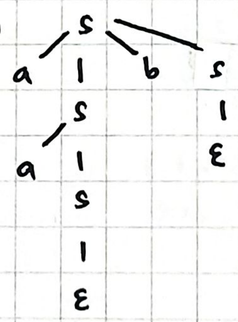
The grammar is ambiguous, show in particular that the string aab has two :

a) Parse trees

1)



2)



b) Leftmost derivations

1) $S \rightarrow aS \rightarrow aaSbS \rightarrow aab$

2) $S \rightarrow aSbS \rightarrow aaSbS \rightarrow aabS \rightarrow aab$

c) Rightmost derivations

1) $S \rightarrow aS \rightarrow aaSbS \rightarrow aaSb \rightarrow aab$

2) $S \rightarrow aSbS \rightarrow aSb \rightarrow aaSb \rightarrow aab$

Exercise 5.4.7

The following grammar generates prefix expressions with operands x and y and binary operators +, -, and *:

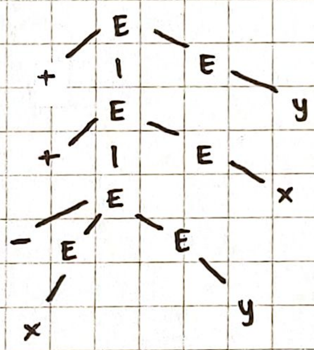
$E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$

a) Find leftmost & rightmost derivations, and a derivation tree for the string +*-xyxy

LM: $E \rightarrow +EE \rightarrow +*EEE \rightarrow +*-EEEE \rightarrow +*-xEEE \rightarrow +*-xyEE$
$\rightarrow +*-xyxE \rightarrow +*-xyxy$

RM: $E \rightarrow +EE \rightarrow +Ey \rightarrow +*EEy \rightarrow +*Exy \rightarrow +*-EExy$
$\rightarrow +*-Eyxy \rightarrow +*-xyxy$

Derivation tree :



b) Prove that grammar is unambiguous.

Pada grammar ini, setiap production rule memiliki awalan yg berbeda (+, *, -, x, y). Utk string yg termasuk dlm EFL ini, apabila diambil leftmost derivation E, langkah berikutnya bergantung dgn simbol yg ingin dimunculkan dr w. Krn awalan tiap production rule berbeda, mk dijamin hanya terdapat satu rule yg dpt dipakai pd saat itu. Maka dijamin hanya ada satu leftmost derivation utk w dan grammar terbukti tdk ambigu.