

Homework 7

Friday, November 15, 2019 9:26 PM

Q1: Suppose the context-sensitive grammar

$S \rightarrow bSAA \mid \epsilon$

$A \rightarrow a$

$bA \rightarrow Ab$

where S is the starting symbol of the grammar. Give a derivation of the string "aaabaaabb". What can you say about the number of a s and b s in the strings recognised by this grammar.

A1:

S
|
bSAA
|
bbSAAAA
|
bbbSAAAAAA
|
bbbAAAAAA
|
bbAbAAAAA
|
bbAAbAAAA
|
bbAAAbAAA
|
bbAAAAbAA
|
bbAAAAAbA
|
bbAAAAABb
|
bAbAAAAAb
|
bAAbAAAAb
|
bAAAbAAAb
|
bAAAbAAAb
|
bAAAbAAAb
|
bAAAAbAb
|
bAAAAAbb
|
AbAAAAAbb
|
AAbAAAAAbb
|
AAAbAAAbb
|

```

aAAbAAAbb
|
aaAbAAAbb
|
aaabAAAbb
|
aaabaAAbb
|
aaabaaAbb
|
aaabaaabb

```

the number of *a*'s will always be twice the number of *b*'s.

Q2: Consider the following grammar

```

S ::= N · P
P ::= V · N
N ::= N · N
N ::= A · N
N ::= student | trainer | team | trains
V ::= trains | team
A ::= The | the

```

where S is the start symbol and S, P, N, V and A are non-terminals. Using the CYK-algorithm, check whether or not the following string can be parsed by the grammar:

The trainer trains the student team

A2:

N/S						
N	N/S					
X	N	N/P				
N	X	N	N			
N	N	X	N	N		
A	N	N/V	A	N	N/V	
The	trainer	trains	the	student	team	

Q3: Transform the grammar

```

A → 0A1 | BB
B → ε | 2B

```

into Chomsky normal form.

A3:

```

A --> 0 A' | B | B B
A' --> A 1
B --> 2 B
0 --> 0
1 --> 1
2 --> 2

```

Q4: Consider the following grammar G

$S \rightarrow \text{if0} \cdot E \cdot \text{then} \cdot S$
 $S \rightarrow \text{print} \cdot S$
 $S \rightarrow \text{begin} \cdot B \cdot \text{end}$
 $B \rightarrow S \cdot ;$
 $B \rightarrow S \cdot ; \cdot B$
 $S \rightarrow \text{num}$
 $E \rightarrow \text{num}$
 $B \rightarrow \text{num}$

where S is the start symbol and S, E and B are non-terminals.

Check each rule below and decide whether, when added to G, the combined grammar is ambiguous. If yes, give a string that has more than one parse tree.

- (i) $S \rightarrow \text{if0} \cdot E \cdot \text{then} \cdot S \cdot \text{else} \cdot S$
- (ii) $B \rightarrow B \cdot B$
- (iii) $E \rightarrow (\cdot E \cdot)$
- (iv) $E \rightarrow E \cdot + \cdot E$

A5:

- (i) will become ambiguous with string "if0 0 then if0 0 then 0 else 0""
- (ii) will become ambiguous with string "begin 0;0;0; end"
- (iii) will not become ambiguous
- (iv) will not become ambiguous