



Tutorial Letter 102/0/2024

Theoretical Computer Science III

COS3701

School of Computing

Assignment 01

BAR CODE

ASSIGNMENT 01
UNIQUE ASSIGNMENT NUMBER: 170585
STUDY MATERIAL: Cohen, chapters 12 - 15

Question 1

[6]

Consider the following CFG:

$$S \rightarrow aS \mid ba$$

Prove that this generates the language defined by the regular expression a^*ba

Question 2

[8]

Find CFGs for the following languages over the alphabet $\Sigma = \{a, b\}$:

All words that do not have the substring ab .

Question 3

[14]

Investigate each of the CFGs provided and decide whether the word $abba$ is generated by the given CFGs. In the case where $abba$ is not generated a brief discussion why a particular CFG does not generate $abba$. If $abba$ is indeed generated, then draw the corresponding syntax tree illustrating the generation of $abba$.

1. CFG 1: $S \rightarrow aSb \mid ab$

2. CFG 2: $S \rightarrow aS \mid bS \mid a$

3. CFG 3: $S \rightarrow aS \mid aSb \mid X$
 $X \rightarrow aXa \mid a$

4. CFG 4: $S \rightarrow aAS \mid a$
 $A \rightarrow SbA \mid SS \mid ba$

5. CFG 5: $S \rightarrow aB \mid bA$
 $A \rightarrow a \mid aS \mid bAA$
 $B \rightarrow b \mid bS \mid aBB$

Question 4**[10]**

Convert the grammar below to CNF.

$$\begin{aligned} S &\rightarrow aX \mid Yb \\ X &\rightarrow ZXZY \mid a \\ Y &\rightarrow b \mid bY \mid \Lambda \\ Z &\rightarrow a \mid \Lambda \end{aligned}$$
Question 5**[12]**

Develop a DPDA accepting the language $L = \{b^{n+1}(ab)a^{n-1} \mid n \geq 2\}$

@
Unisa
2024