TOC- Assignment

Q1) $\mathcal{L}$: Language over {a,b} generated by the grammar:

$S \rightarrow aSa$

$S \rightarrow \varepsilon$

Sol:- For a grammar to be linear, it has to either satisfy the requirements of LEFT LINEAR GRAMMAR (or) RIGHT LINEAR GRAMMAR. ∴ Given grammar is NOT-LINEAR

For the given grammar,

$L = \{\varepsilon, aa, aaaa, aaaaaa, \ldots\}$

This has even number of a's

∴ The language (L) generated is LINEAR.

We can generate L, from a LINEAR grammar below.

$S \rightarrow aT$

$T \rightarrow aS$

$S \rightarrow \epsilon$

This grammar results in linear language.

∴ We can say that L is LINEAR.

NOTE:- With the above proofs, we can come to the conclusion that, All the languages generated by NON-LINEAR GRAMMAR need not be NON-LINEAR.

Q2) Context-free Grammar(G) generates all strings of balanced left and right parentheses.
Construct a stack Machine(M) for it.

Sol:- Context-Free Grammar:-

$S \rightarrow (S)$

$S \rightarrow \epsilon$

Now, the Stack Machine(M) is:-

read	pop	push
ϵ	S	(S)
ϵ	S	ϵ
(	(	ϵ
)	)	ϵ

Q3) Context-free Grammar(G) for the language of palindromes over {a,b}
Construct a stack machine (M).

Sol:- Context-Free Grammar:-

$S \rightarrow aSa$

$S \rightarrow bSb$

$S \rightarrow a$

$S \rightarrow b$

$S \rightarrow \epsilon$

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Now,

Stack Machine is as below:

read	pop	push
ϵ	S	aSa
ϵ	S	bSb
ϵ	S	a
ϵ	S	b
ϵ	S	ϵ
a	a	ϵ
b	b	ϵ

Q4) Context-free Grammar (G) is given below. What language does this grammar generate.

Sol:

$S \rightarrow 0B / 1A$

$A \rightarrow 0 / 0S / 1AA$

$B \rightarrow 1 / 1S / 0BB$

This grammar generates, strings with equal number of 0's and 1's, with a note that it just contains 0's and 1's and nothing else.

$\therefore$ L can be represented as:-

$L = \{ x / x \in (0,1)^+$ and with the ~~note that~~ count of 0's in x = count of 1's in $x \}$

Q5) Context-free Grammar is given below. What language does it generate?

Sol:-

$S \rightarrow \epsilon / 0S / 1T$

$T \rightarrow 0T / 1S$

The language generated by the given grammar is :-

Strings of 0's and 1's with even number of 1's.

Represented as:-

$L = \{ x / x \in (0,1)^+$ and count of 1's in x is EVEN $\}$

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