

- 1) Give the regular expression for the languages on $\Sigma = \{a, b, c\}$ all strings containing exactly two a.

$$r = aab^*c^*$$

- 2) Give the regular expression for the language accepting all the string in which any number of c's is followed by even numbers of b's is followed by any number of a's

$$r = c^*(bb)^*a^*$$

- 3) Find grammars for $\Sigma = \{a, b, c\}$ that generate the sets of

- a.) all strings with exactly one a and c

$$G = (\{S, A\}, \{a, b, c\}, S, P)$$

$$S \rightarrow AaAcA$$

$$A \rightarrow bA \mid Ab \mid \lambda$$

- b.) all strings where the number of a is more than the number of b by 2 and \exists is no c

$$G = (\{S, A\}, \{a, b, c\}, S, P)$$

$$S \rightarrow AaAaAaAb$$

$$A \rightarrow AaAb \mid \lambda a \lambda b$$

4) Find a regular grammar that generates the language $L(aa^*(ab+a)^*)$

$$G = (\{S, A, B\}, \{a, b\}, S, P)$$

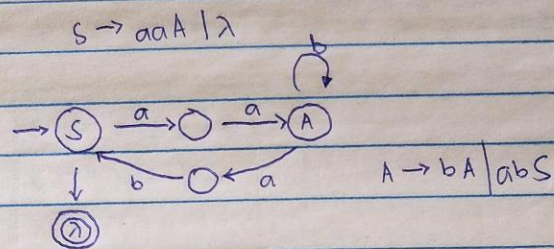
$S \rightarrow aaA$
$A \rightarrow aA \mid abB$
$B \rightarrow a \mid a\lambda$

5) Construct a right linear-grammar for the language $L((aabb^*ab)^*)$

$$G = (\{S, A\}, \{a, b\}, S, P)$$

$S \rightarrow a a A \mid \lambda$
$A \rightarrow b A \mid a b S$

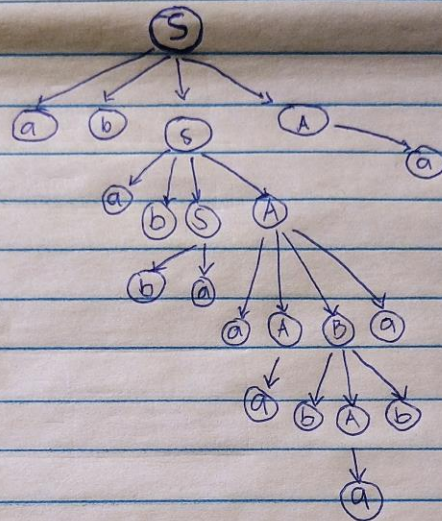
6) Construct the NFA of the right linear grammar of problem 5



7) Given the grammar below, derive using leftmost and rightmost Derivation of "ababbbbaa a aabbaa"

$S \rightarrow abSA \mid ba$
$A \rightarrow aABa \mid a$
$B \rightarrow bAb \mid b$

8.) Derive the sentence "ababba aababa a" from the grammar in problem 7 using the derivation tree



a) Construct the CFG for the language $L(S) = \{a^{n+2}b^m c^{n+1} : n \geq 0, m \geq 1\}$

$S \rightarrow aaSc B \lambda$
$B \rightarrow bB \lambda$

b) Derive one sentence from the grammar in problem 9 using a derivation tree

$\rightarrow S \rightarrow aaSc \rightarrow aaaaSec \rightarrow aaaaBcc \rightarrow aaaaabBcc \rightarrow aaaaabcc$
