

January 30th 2025

Detroit Michigan.

Assignment I: Basic Grammar.

1. Find grammar for $\Sigma = \{a, b\}$ that generate the sets of all strings with at least three a's.

$$S \rightarrow A a A a A a$$

$$A \rightarrow aA \mid bA \mid \lambda$$

2. Let $\Sigma = \{a, b\}$. For each of the following languages, find a grammar that generates it.

$$L = \{a^{3n}b^{2n} : n \geq 2\}$$

$$n=2 \quad a^6b^4 \Rightarrow \underline{aaaaaa}bbbbb$$

$$n=3 \quad a^9b^6 \Rightarrow \underline{aaaaaaaaa}bbbbb$$

$$n=4 \quad a^{12}b^8 \Rightarrow \underline{aaaaaaaaaa}bbbbb$$

$$S \rightarrow \underline{aaaaaa}Abbbb$$

$$A \rightarrow \underline{aAb} \mid \underline{aaaAbb} \mid \lambda$$

$$(3) 2.2 \quad L = \{a^{n+3}b^n : n \geq 2\}$$

$$n=2 \quad \underline{aaaaa}bb$$

$$n=3 \quad \underline{aaaaaa}bbb$$

$$n=4 \quad \underline{aaaaaaa}bbbb$$

$$S \rightarrow \underline{aaaaa}Abb$$

$$A \rightarrow \underline{aAb} \mid \lambda$$

$S \rightarrow aA / aaA$
 $A \rightarrow aaaA / \lambda$

Correct Version

4. Find grammars for the following languages on $\Sigma = \{a\}$

$L = \{w : |w| \bmod 3 > 0\}$

$\not\equiv \bmod 3 > 0$

~~$S \rightarrow aS / aaS / aaaA / aA / aaA$~~

~~$A \rightarrow aaaA / \lambda$~~

~~$S \rightarrow a / aa / aA$~~

~~$A \rightarrow aA / aaaA / a$~~

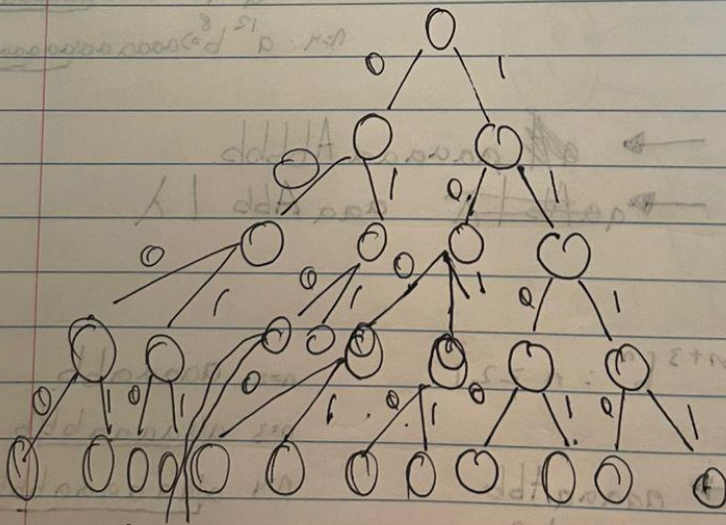
$a \bmod 3 > 0$

$aa \bmod 3 > 0$

$aaa \bmod 3 = 0$

$6 \bmod 3 = 0$

5. Design a transducer to convert a binary string into hexadecimal.
For example, the bit string 1111 1100 1001 1010 = FC9A



a}

d3 > 0

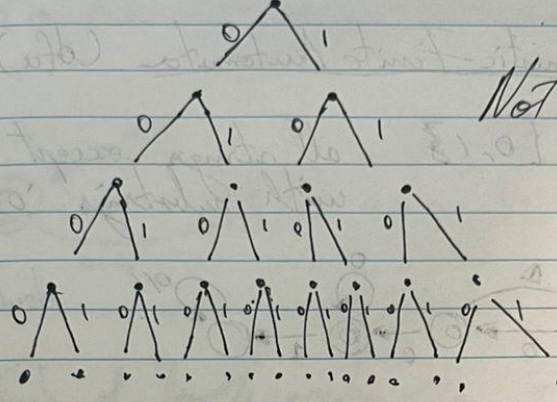
3 > 0

3 > 0

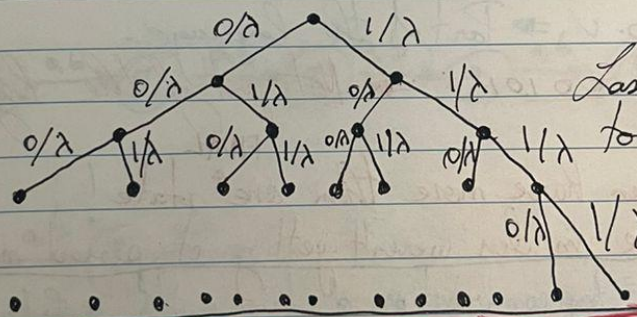
3 > 0

3 = 0?

code line



Not quite tight



Last bit needs to secure the result and 1/λ not return "λ"

