Notes 5

More complex
$$\begin{cases} A \to x\,B \\ A \to x \end{cases} \qquad x \in T^*$$

Simpler
$$\begin{cases} A \to a\,B \\ A \to a \end{cases}$$
Only λ cannot be generated. (Handle separately)

Why are these equivalent regular grammars? Both can generate the same languages!

Easy Part: Complex $\Rightarrow$ simple.

Harder Part: Simple $\Rightarrow$ complex.

$A \to a_1 a_2 a_3 \cdots a_n B$ For $n \geq 2$ we replace this by

$A \to a_1 X_1$
$X_1 \to a_2 X_2$
$X_2 \to a_3 X_3$
$\vdots$
$X_{n-1} \to a_n B$

Similarly for $A \to a_1 a_2 \cdots a_n$
$A \to a_1 X_1$
$X_1 \to a_2 X_2$
$X_2 \to a_3 X_3$
$\vdots$
$X_{n-1} \to a_n$

Example $G = (\Sigma = \{a,b,c\}, N = \{S, A\}, S, P\}$
$S \to bA$
$A \to aaA \mid b \mid c$
What is $L(G)$?

$L(G) = \{b a^{2n} b\} \cup \{b a^{2n} c\} \quad n \geq 0$
or
$b(a^2)^*(b+c)$