PROCEDURE FOR REDUCING A CFG to GNF

→ G-A CFG, RENAME/REARRANGE THE VARIABLES AS $(A_1, A_2, \ldots A_n)$ WITH START SYMBOL AS A_1.

STEP-1 : MODIFY THE PRODUCTIONS SUCH THAT $A_i \to A_j \gamma$ WHERE $i < j$.

STEP-2 : IF $A_k \to A_j \gamma$ IS A PRODUCTION WITH $j < k$ (or $k > j$)
GENERATE A NEW SET OF PRODUCTIONS BY SUBSTITUTING FOR A_j, THE RIGHT HANDSIDE OF THE A_j PRODUCTION.
BY REPEATING THIS WE OBTAIN PRODUCTIONS OF THE FORM,

$$A_k \to A_l \alpha \text{ . WHERE } l \geq k.$$

THE PRODUCTION WITH $l = k$ ARE REPLACED WITH 2nd LEMMA.

BY REPEATING THE ABOVE STEPS FOR EACH VARIABLE WE OBTAIN THE REQUIRED FORM.

EXAMPLE: $S \to AA \mid a$

$A \to SS \mid b$

LET ARRANGE AS (S, A) A_1, A_2

$A_1 \to A_2 A_2 \mid a$ ✓

$A_2 \to A_1 A_1 \mid b$ ✓ (NOT GNF)

STEP-1 $A_1 \to A_2 A_2$ NOT GNF IN DESIRED FORM

NOW $A_2 \to A_1 A_1$.

$A_2 \to A_2 A_2 A_1 \mid a A_1 \mid b$

STEP-2 ELIMINATE RECURSION.