

Exercise1 (Useless Symbols)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (S \rightarrow a|A; A \rightarrow AB; B \rightarrow b)$$

- Clean the grammar G to reach grammar without useless symbols.

Exercise2(ϵ – rules)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (S \rightarrow aSbS|bSaS|\epsilon)$$

- Give the equivalent ϵ – *free* grammar to G .

Exercise3 (Unit production)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (E \rightarrow E + T|T; T \rightarrow T * F|F; F \rightarrow (E)|a)$$

- Give the equivalent grammar to G without unit rules.

Exercise4(CNF)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (S \rightarrow aAB|BA; A \rightarrow BBB|a; B \rightarrow AS|b)$$

- Give the type of G according to Chomsky classification.
- Transform G to Chomsky Normal Form.

Exercise5(Left Recursion Elimination)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (A \rightarrow BC|a; B \rightarrow CA|Ab; C \rightarrow AB|CC|a)$$

- Give the type of G according to Chomsky classification.
- Give the equivalent grammar after eliminating the left recursion.

Exercise(GNF)

Let the grammar $G = (N, T, S, P)$

Where the rewriting rules are:

$$P = (E \rightarrow T|TE'; E' \rightarrow +T|+TE'; T \rightarrow F|FT'; T' \rightarrow *F|*FT'; F \rightarrow (E)|a)$$

- Give the type of G according to Chomsky classification.
- Transform G to Greibach Normal Form.