CNF Algorithm

Unit Production
□ → □

→ We have 4 main steps

1. Eliminate empty production:
اى case تلاقى فيها ال ε بتشيلها و بنعوض بكل
ال possible cases

ie: AxB & {A & B may be nullable
∴ AxB | xB | Ax | x → the 4 possible cases.

2. Eliminate Variable Unit Production
لو فيه variable ملهوش غير قيمة واحدة فا خلاص
عوض بيه.

3. Replace Long productions by short ones:
اى case فيها اكتر من حرفين ، قسمها.

ie: A → BCDE
↓
A → KL
K → BC , L → DE

وخد بالك إن عندنا 2 allowed cases only

X → XX or X → x

اما حرف Capital بيشاور على حرفين Capital
او حرف Capital بيشاور على حرف small

4. Move Terminal to Unit Production
A → bC ⇒ A → BC
B → b

$X \to 0X \mid 1X \mid \epsilon$

Steps For Removal of Unit production:-

→ We have 3 main steps:-

1. To remove $A \to B$, add production $A \to X$ to the grammar rule whenever $B \to X$ occurs in the grammar where [X → Terminal]

(5)

2. Delete $A \to B$ from the grammar
3. Repeat from step 1 until all Unit Productions are removed.

$Y \to a$ ✓

Example:-

$S \to XY,\ X \to a,\ Y \to Z \mid b,\ Z \to M,\ M \to N,\ N \to a$

Solution:

Unit productions:
$Y \to Z,\ Z \to M$
$M \to N$ ✓

1 variable يتغير ب 1 variable another ويشار عليه

1) Since $N \to a$ ∴ $M \to a$ add this to our grammar & remove $M \to N$

∴ $S \to XY,\ X \to a,\ Y \to Z \mid b,\ Z \to M$
~~$M \to N$~~, $M \to a,\ N \to a$

2) Repeat :

∵ $Z \to M$ & $M \to a$ ∴ $Z \to a$

∵ $Y \to Z$ & $Z \to a$ ∴ $Y \to a$

$S \to XY,\ X \to a,\ Y \to a \mid b,$ ~~$Z \to a,\ M \to a,\ N \to a$~~

∴ Final Grammar But, Now Z, M, N Can not be reached from S, so we need to apply modification.

→ Remove unreachable variables. ✓

final → $S \to XY,\ X \to a,\ Y \to a \mid b$

Example:-

$S \to aXbX$

$X \to aY \mid bY \mid \varepsilon$

$Y \to X \mid c$

Important Note

مهم!!

لو عندنا $A \to X \mid \varepsilon$ و $B \to A$ فهنا
واضح ان A ممكن تبقى Null
لكن متنساش ان B هي كمان ممكن
تبقى Null فلازم تعمل نفس الكلام
عليها

Step1: Replace all Nullables

$S \to aXbX \mid abX \mid$ ~~[illegible]~~ $\mid aXb \mid ab$

$X \to aY \mid bY \mid a \mid b$ → In case $bY = X$ & X is Null

$Y \to X \mid c$

Step2: Eliminate variable unit Production

ال Y اللي قدامها غير ال variable X فنعوض بيه فيهم كلهم

$S \to aXbX \mid abX \mid aXb \mid ab$

$X \to aY \mid bY \mid a \mid b$

$Y \to aY \mid bY \mid a \mid b \mid c$ (X)

Step3:- Replace all long terms with short terms.

$EF \to AXBX \to aXbX$

$E \to AX$

$F \to BX$

$A \to a$

$B \to b$

∴ $S \to EF \mid AF \mid EB \mid AB$

→ $X \to AY \mid BY \mid a \mid b$

→ $Y \to AY \mid BY \mid a \mid b \mid c$

$E \to AX$ $F \to BX$

$A \to a$ $B \to b$

Done ✓✓