

TOA

①

ASSIGNMENT 3

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3 ← 1 2 3 4 5 6 7 8

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3 ← 1 2 3 4 5 6 7 8

Section: 6A

3 ← 1 2 3 4 5 6 7 8

Q: 1) CFG To CNF

3 ← 1 2 3 4 5 6 7 8

A) $S \rightarrow TUIV$

3 ← 1 2 3 4 5 6 7 8

$T \rightarrow aTb1\epsilon$

3 ← 1 2 3 4 5 6 7 8

$U \rightarrow cU1\epsilon$

3 ← 1 2 3 4 5 6 7 8

$V \rightarrow aVc1w$

3 ← 1 2 3 4 5 6 7 8

$W \rightarrow bW1\epsilon$

3 ← 1 2 3 4 5 6 7 8

Sol:

3 ← 1 2 3 4 5 6 7 8

① Adding start state $S_0 \rightarrow S$

3 ← 1 2 3 4 5 6 7 8

$S_0 \rightarrow S$

$S_0 \rightarrow S$

~~$S \rightarrow aSb1\epsilon$~~

$S \rightarrow TUIV$

3 ← 1 2 3 4 5 6 7 8

~~$A \rightarrow B1\epsilon$~~

$T \rightarrow aTb1\epsilon$

3 ← 1 2 3 4 5 6 7 8

~~$B \rightarrow b1\epsilon$~~

$U \rightarrow cU1\epsilon$

3 ← 1 2 3 4 5 6 7 8

~~$x \rightarrow \epsilon$~~

$V \rightarrow aVc1w$

3 ← 1 2 3 4 5 6 7 8

$W \rightarrow bW1\epsilon$

3 ← 1 2 3 4 5 6 7 8

3 ← 1 2 3 4 5 6 7 8

AOT

② Remove $T \rightarrow \epsilon$

~~S - TUIVIUUTIEA~~ A

$S_0 \rightarrow S$

$S \rightarrow TUIVIU$

$T \rightarrow aTb|ab$

$U \rightarrow cUc|c$

$V \rightarrow aVc|w$

$W \rightarrow bw1\epsilon$

Remove $U \rightarrow \epsilon$

VIUT \leftarrow A

~~31dPTP \leftarrow T~~

~~31UJ \leftarrow U~~

~~31jzVz \leftarrow V~~

~~31wd \leftarrow W~~

$S_0 \rightarrow S$

$S \rightarrow TUIVIUUTIE$

$T \rightarrow aTb|ab$

$U \rightarrow cUc|c$

$V \rightarrow aVc|w$

$W \rightarrow bw1\epsilon$

Remove $W \rightarrow \epsilon$

~~2<-2 2>8~~

$S_0 \rightarrow S$

VIUT \leftarrow A

~~31dPTP \leftarrow T~~

$S \rightarrow TUIVIUUTIE$

~~31dPTP \leftarrow T~~

~~31dPTP \leftarrow T~~

$T \rightarrow aTb|ab$

~~31UJ \leftarrow U~~

~~31dPTP \leftarrow T~~

$U \rightarrow cUc|c$

~~31jzVz \leftarrow V~~

~~31dPTP \leftarrow T~~

$V \rightarrow aVc|w$

~~31wd \leftarrow W~~

~~31dPTP \leftarrow T~~

$W \rightarrow bw1b$

(2)

Remove $V \rightarrow \epsilon$

$S_0 \rightarrow S$

$S \rightarrow \del{S}, TUVIUVIT\epsilon$

$T \rightarrow aTb1ab$

$U \rightarrow cU1c$ no. of terminals of production

$V \rightarrow aVc1W1ac$

$W \rightarrow bW1b$

no. of terminals of production (2)

Remove $S \rightarrow \epsilon$

$S_0 \rightarrow S1\epsilon$

$S \rightarrow TUVIUVIT$

$T \rightarrow aTb1ab$

$U \rightarrow cU1c$

$V \rightarrow aVc1W1ac$

$W \rightarrow bW1b$

$a \in Q$

$b \in Q$

$c \in Q$

$d \in Q$

$e \in Q$

$f \in Q$

$g \in Q$

$h \in Q$

$i \in Q$

$j \in Q$

(3) Remove unit production

① $V \rightarrow W$

② $S \rightarrow U1V1T$

③ $S_0 \rightarrow S$

$d \in Q \cup P$

$a \in Q$

no. of terminals of production (2)

Apply a. all three :-

$S_0 \rightarrow TUVIaVc1bW1b1a1c1cU1c1a1Tb1ab1\epsilon$

$S \rightarrow TUVIaVc1bW1b1a1c1cU1c1a1Tb1ab1\epsilon$

$T \rightarrow aTb1ab$

$a \in Q \cup P$

$U \rightarrow \del{S} cU1c$

$c \in Q$

$V \rightarrow aVc1bW1b1a1c1cU1c1a1Tb1ab1\epsilon$

$a \in Q \cup P$

$W \rightarrow bW1b$

$b \in Q$

④ eliminate useless symbols

~~Q, R, S, T, U, V, W~~

{a, b, c, S, U, V, W} - E

dot dot P ← T

nothing to eliminate as all are in L

nothing to do G V

⑤ Adding new Production

P → a
Q → b
R → c

3 ← 2 second

312 ← 2

TU1V1U1T ← 2

S₀ → TU1PV1QW1b1PR1R1U1C1PTQ1PQ1E Q → b

S → TU1PV1QW1b1PR1R1U1C1PTQ1PQ R → C

T → PTQ1PQ

dot dot / CVA ← V

U → RU1C

dot dot / CVA ← W

V → PVR1QW1b1PR

W → QW1b

P → a

Adding new Production

Z → PV

Y → PT

S₀ → TU1Z1QW1b1PR1R1U1C1V1Q1PQ1E

S → TU1Z1R1QW1b1PR1R1U1C1V1Q1PQ

T → V1PQ

dot dot P ← T

U → RU1C

dot dot / CVA ← U

V → Z1R1QW1b1PR / dot dot / CVA ← V

W → QW1b

dot dot ← W

P → a

Q → b

R → C

Z → PV

Y → PT

to eliminate as all non terminal are in L

(3)

$$B) S \rightarrow ASA1B_aB$$

$$A \rightarrow B1S$$

$$B \rightarrow b1\epsilon$$

$$X \rightarrow A$$

$$S \leftarrow X \quad \text{initial}$$

$$2 \leftarrow \epsilon$$

$$A1Ae12A1d1g1A2A \leftarrow \epsilon$$

$$21g \leftarrow A$$

$$d \leftarrow \emptyset$$

$$A \leftarrow X$$

Sol:

① Adding new starting state

$$S_0 \rightarrow S$$

$$2 \leftarrow \epsilon \text{ (1)}$$

$$S \rightarrow ASA1aB$$

$$2 \leftarrow \epsilon \text{ (2)}$$

$$A \rightarrow B1S$$

$$21g \leftarrow A \text{ (3)}$$

$$\cancel{B \rightarrow b1\epsilon}$$

$$A \leftarrow X \text{ (4)}$$

$$X \rightarrow A$$

② Remove $B \rightarrow \epsilon$

$$S_0 \rightarrow S$$

$$A212A1d1g1A2A \leftarrow \epsilon$$

$$S \rightarrow ASA1aB1a$$

$$A212A1d1g1A2A1d \leftarrow A$$

$$A \rightarrow B1S1\epsilon$$

$$d \leftarrow \emptyset$$

$$B \rightarrow b$$

$$A212A1d1g1A2A1d \leftarrow \epsilon$$

$$X \rightarrow A$$

Remove $A \rightarrow \epsilon$

$$S_0 \rightarrow S$$

$$S \rightarrow ASA1aB1a$$

$$A \rightarrow B1S1$$

$$B \rightarrow b$$

$$X \rightarrow A1\epsilon$$

closure as all non terminal are in {}

Remove $X \rightarrow \epsilon$

$S \rightarrow AAB \leftarrow 2 \leftarrow B$

$S \rightarrow A$

$S_0 \rightarrow S$

$S \leftarrow A$

$S \rightarrow ASA1aB1a1AS1SA1S$

$A \leftarrow X$

$A \rightarrow B1S$

$B \rightarrow b$

$X \rightarrow A$

③ Remove Unit production

① $S \rightarrow S$

$S \leftarrow A$

② $S_0 \rightarrow S$

$S \leftarrow A$

③ $A \rightarrow B1S$

$B \leftarrow A$

④ $X \rightarrow A$

$X \leftarrow A$

$A \leftarrow X$

Applying step by step we get:-

$S_0 \rightarrow ASA1aB1a1AS1SA$

$S \rightarrow ASA1aB1a1AS1SA$

$A \rightarrow b1AS1aB1a1AS1SA$

$b1A \leftarrow A$

$B \rightarrow b$

$b1A \leftarrow A$

$X \rightarrow b1ASA1aB1a1AS1SA$

$d \leftarrow A$

$A \leftarrow X$

④ eliminate useless symbol.

{ $\bar{a}, \bar{b}, \bar{S}_0, \bar{S}, \bar{A}, \bar{X}, \bar{B}$ }

Nothing to eliminate as all are in { $\bar{a}, \bar{b}, \bar{S}_0, \bar{S}, \bar{A}, \bar{X}, \bar{B}$ }

⑤ Adding new production

contradict with pibtA. (2)

$$\begin{array}{|c|} \hline P \rightarrow AS \\ Q \rightarrow a \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline a \leftarrow q \\ D \leftarrow D \\ \hline \end{array}$$

$$S_0 \rightarrow PA1QB1a1AS1SA$$

$$2D1AS1D \leftarrow E$$

$$S \rightarrow PA1QB1a1AS1SA$$

$$9D \leftarrow A$$

$$A \rightarrow b1PA1QB1a1AS1SA$$

$$21D1DA \leftarrow D$$

$$B \rightarrow b$$

$$89 \leftarrow q$$

$$X \rightarrow b1PA1\cancel{q}QB1a1AS1SA$$

$$D \leftarrow D$$

$$P \rightarrow AS$$

$$Q \rightarrow a$$

C) $S \rightarrow a1aA1aB$

$$A \rightarrow aBB1E$$

$$B \rightarrow Aa1b$$

① no need to add new starting state as $S \rightarrow S$

② Remove $A \rightarrow \epsilon$

$$S \rightarrow a1aA1aB$$

$$A \rightarrow aBB$$

$$B \rightarrow Aa1b1a$$

③ no unit production to remove

④ Eliminating useless symbol

$$\{a, b, S, B, A\}$$

nothing to eliminate as all non terminal are in {}

⑤ Adding New Production

adding new rule ②

$$\begin{array}{|c|} \hline P \rightarrow BB \\ Q \rightarrow q \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline 2A \leftarrow q \\ A \leftarrow B \\ \hline \end{array}$$

$$S \rightarrow a1QA1QB$$

$$A212A1P1S01A9 \leftarrow \beta$$

$$A \rightarrow QP$$

$$A313A1L18D1A9 \leftarrow \alpha$$

$$B \rightarrow A\alpha 1b1q$$

$$A212A1L18D1A91d \leftarrow \gamma$$

$$P \rightarrow BB$$

$$d \leftarrow \delta$$

$$Q \rightarrow q$$

$$A212A1P1S01A91d \leftarrow \chi$$

$$A \leftarrow q$$

$$D \leftarrow \alpha$$

$$A313A1P1S01A9 \leftarrow \beta$$

$$31880 \leftarrow \alpha$$

$$d1e9 \leftarrow \beta$$

add new rule ② note with this set been on ①

$$3 \leftarrow A \text{ removed } ②$$

$$S01A91P1 \leftarrow \beta$$

$$S9A \leftarrow A$$

$$P1d1e9 \leftarrow \beta$$

remove of redistribution from on ②

remove of redistribution from ②

$$(A, \beta, \alpha, d, \delta)$$

(1) no no intent on the no similarity of rules