Never blindly trust anything.

If you find any mistake, kindly correct it and if possible inform in our grp too.

Thank you
18BCE120.

Plz, don't download, use directly from drive, so that If you get most recent and updated answers.

Update / Corrections will be mentioned here :

31/03/2021 Q 3.ii And Q 1.6

05-05-2021 Q. 1(4,5,6)

Update / Corrections will be mentioned here:

31/03/2021 Q 3.ii And Q 1.6

05-05-2021 Q. 1(4,5,6) Q 1(3)

Tutorial-7

[1] Design CFG for given language

$\Sigma = \{0,1\}^*$

[1.] $L = \{0^n 1^{2n} \mid n \geq 0\}$

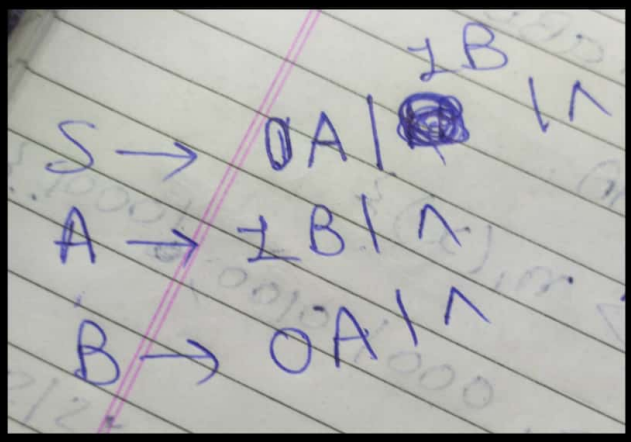
$S_0 \longrightarrow 0S_011 \mid \varepsilon$

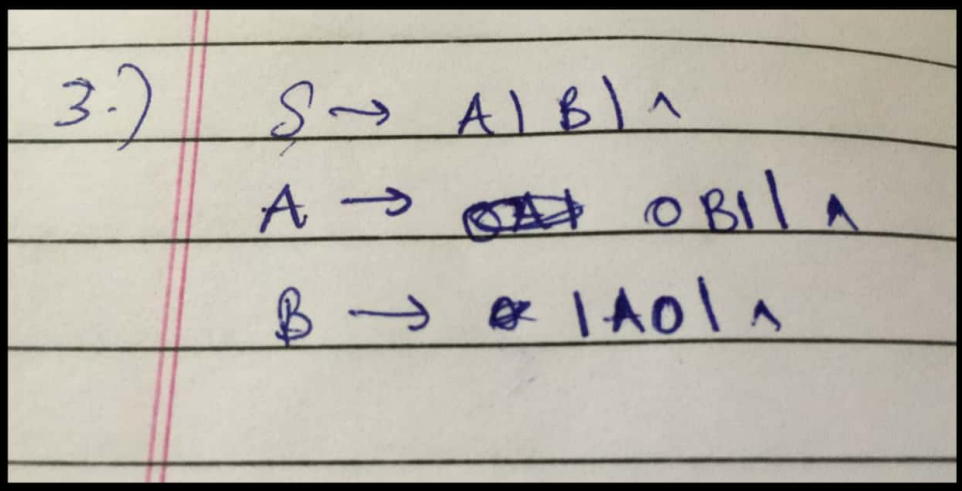
[2] String of even length

$S_0 \longrightarrow aT \mid bT \mid \varepsilon$

$T \longrightarrow aS_0 \mid bS_0$

I have these three answers,
Dekh lo, jo shi lage.

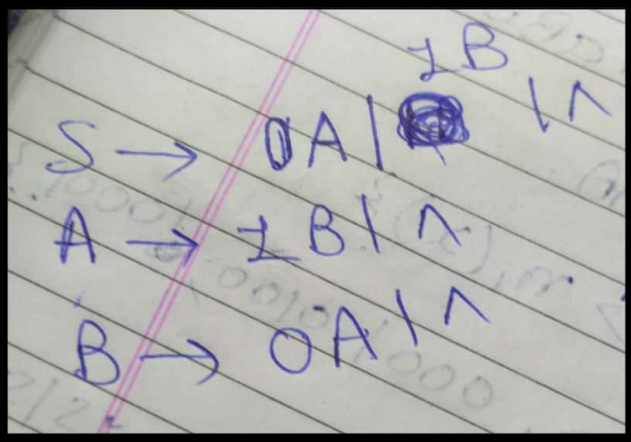


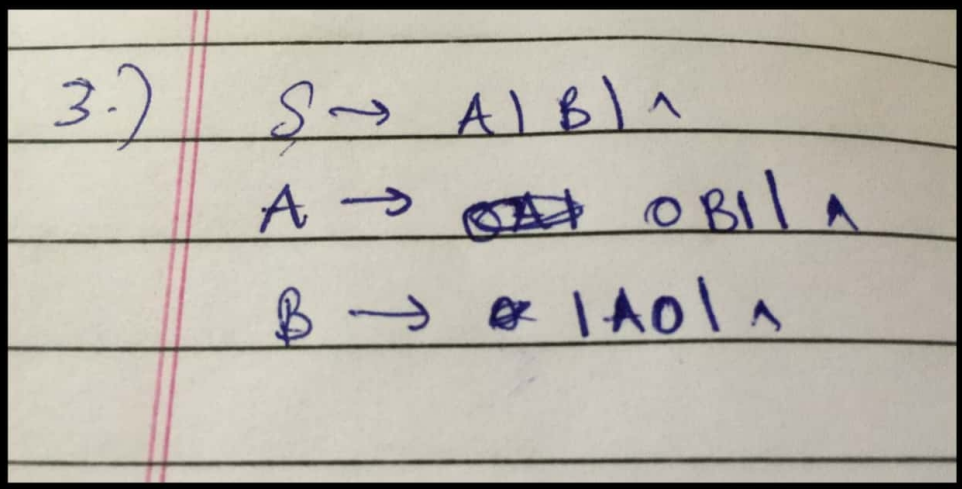


S->01|10|01a|10b
a->01a|0|01
b->10b|1|10

I have these three answers,
Dekh lo, jo shi lage.

3)





S->01|10|01a|10b
a->01a|0|01
b->10b|1|10

4) $a^n b^n c^m \mid n, m \geq 1$ aa bb

$S \rightarrow aAbBc \mid \wedge$

$A \rightarrow aAb \mid \wedge$

$B \rightarrow cB \mid \wedge$

5) $a^n b^n c^m \mid n, m >= 0$

$S \rightarrow aSbC \mid aCC \mid \wedge$ ~~aAbC~~ $\mid \wedge$

$A \rightarrow aAb \mid \wedge$

$C \rightarrow cC \mid \wedge$.

6) $a^n b^n c^m d^m \mid n, m >= 0$.

$S \rightarrow$ ~~aAb~~ $AB \mid \wedge$

$A \rightarrow aAb \mid \wedge$

$B \rightarrow cBd \mid \wedge$.

(2)

Remove unit production.

$S \rightarrow ABCD$
$A \rightarrow a$
$B \rightarrow C \mid b$
$C \rightarrow D$
$D \rightarrow c$

unit productions: $B \rightarrow C$, $C \rightarrow D$

$\Rightarrow$ Remove $C \rightarrow D$

$S \rightarrow ABCD$
$A \rightarrow a$
$B \rightarrow C \mid b$
$C \rightarrow c$
$D \rightarrow c$

$\Rightarrow$ Remove $B \rightarrow C$

$S \rightarrow ABCD$
$A \rightarrow a$
$B \rightarrow c \mid b$
$C \rightarrow c$
$D \rightarrow c$

Answer

3

Remove null production

(i) $S \to ABC \mid AoA$
$A \to oA \mid BoC \mid ooo \mid B$
$C \to CA \mid Ae$
$D \to \Lambda$.

$\Rightarrow$ Null productions:

$D \to \Lambda$ Remove

$S \to ABC \mid AoA$
$A \to oA \mid BoC \mid ooo \mid B$
$C \to CA \mid Ae$

Answer

(ii) $S \to AAA \mid B$
$A \to oA \mid B$
$B \to \Lambda$

$\Rightarrow$ Null production : $B \to \Lambda$, $S \to B$, $A \to B$

Remove $B \to \Lambda$.

$S \to AAA \mid \Lambda$
$A \to oA \mid \Lambda$

Remove null production $A \to \wedge$

$S \to AAA \mid AA \mid A \mid \wedge$

$A \to oA \mid o$

Answer

Extra

$S \to ABCd$

$A \to BC$

$B \to bB \mid \lambda$

$C \to cC \mid \lambda$

$\Longrightarrow$ Null production $C \to \lambda$, $B \to \lambda$, $A \to B$

Remove $C \to \lambda$

$S \to ABCd \mid ABd$

$A \to BC \mid B$

$B \to bB \mid \lambda$

$C \to cC \mid c$

Remove $B \to \lambda$

$S \to ABCd \mid ABd \mid ACd \mid Ad$

$A \to BC \mid B \mid C \mid \lambda$

$B \to bB \mid b$

$C \to cC \mid c$

⇒ Remove $A \to \lambda$.

$S \to ABCd \mid ABd \mid Acd \mid Ad \mid BCd \mid Bd \mid cd \mid d$.

$A \to BC \mid B \mid C$
$B \to bB \mid b$
$C \to cC \mid c$

Answer

(4) [Not sure]

$S \to aA \mid bC \mid b$
$A \to aS \mid bB$
$B \to aC \mid bA \mid a$
$C \to aB \mid bS$

A→B

→ I think.
$L = \{ s \mid s \in \{0,1\}^* \mid |s| \text{ is odd and } n_a \geq 0,\ n_b \geq 1 \}$

Why? simplify

$S \to aA \mid baB \mid bbS \mid b$
$A \to aS \mid bB$
$B \to aaB \mid abS \mid bA \mid a$

Remove ε

Remove A

$S \to aaS \mid abB \mid baB \mid bbS \mid b$
$B \to aaB \mid abS \mid baS \mid bbB \mid a$

⇒ Now, with this grammer everything else is possible.

5

Convert CFG to CNF

$S \rightarrow AACD$
$A \rightarrow aAb \mid \wedge$
$C \rightarrow aC \mid a$
$D \rightarrow aDa \mid bDb \mid \wedge$

$\Longrightarrow$ Step I: Remove null production

nullable variables: D, A.

Remove $D \rightarrow \wedge$.

$S \rightarrow AACD \mid AAC.$
$A \rightarrow aAb \mid \wedge$
$C \rightarrow aC \mid a$
$D \rightarrow aDa \mid bDb \mid aa \mid bb$

Remove $A \rightarrow \wedge$

$S \rightarrow AACD \mid AAC \mid ACD \mid AC \mid CD \mid C$
$A \rightarrow aAb \mid ab$
$C \rightarrow aC \mid a$
$D \rightarrow aDa \mid bDb \mid aa \mid bb$

⇒ Step 2 :

Remove unit production.

$S \to C$

$S \to AACD \mid AAC \mid ACD \mid AC \mid CD \mid aC \mid a$
$A \to aAb \mid ab$
$C \to aC \mid a$
$D \to aDa \mid bDb \mid aa \mid bb$

⇒ Step 3 :

Reduce $S \to AACD$
$\therefore S \to AH_0 \quad H_0 \to ACD$

Reduce $H_0 \to ACD$
$\therefore H_0 \to AH_1 \quad H_1 \to CD$

Reduce $S \to AAC$
$\therefore S \to AH_2 \quad H_2 \to AC$

Reduce $S \to ACD$
$\therefore S \to AH_1$

Reduce $A \to aAb$
$\therefore A \to aH_3 \quad H_3 \to Ab$

Reduce $D \to aDa$
$\therefore D \to aH_4 \quad H_4 \to Da$

: Reduce

~~Remove~~ $D \rightarrow bDb$

$\therefore D \rightarrow bH_5 \quad H_r \rightarrow Db$

~~Reduce~~

after Step 3

$S \rightarrow AH_0 | AH_2 | AH_1 | Ae | CD | aC | a$

$A \rightarrow aH_3 | ab$

$C \rightarrow aC | a$

$D \rightarrow aH_4 | bH_r | aa | bb$

$H_0 \rightarrow AH_1$
$H_1 \rightarrow CD$
$H_2 \rightarrow Ae$
$H_3 \rightarrow Ab$
$H_4 \rightarrow Da$
$H_r \rightarrow Db$

⟹ Step 4

~~Re~~: Convert $S \rightarrow$ ~~a~~aC

$\therefore S \rightarrow H_6C \quad H_6 \rightarrow a$

Convert $A \to aH_3$

$\therefore A \to H_6H_3$

Convert $A \to ab$

$\therefore A \to H_6H_7 \quad H_7 \to b$

Convert $C \to aC$

$\therefore C \to H_6C$

Convert $D \to aH_4$

$\therefore D \to H_6H_4$

Convert $D \to bH_7$

$\therefore D \to H_7H_7$

Convert $D \to aa$

$\therefore D \to H_6H_6$

Convert $D \to bb$

$\therefore D \to H_7H_7$

Convert $H_3 \to Ab$

$\therefore H_3 \to AH_7$

Convert $H_4 \to Da$

$\therefore H_4 \to DH_6$

Convert $H_7 \to Db$

$\therefore H_7 \to DH_7$

CNF

S → AH0 | AH2 | AH1 | Ae | CD | H6C | 9

A → H6H5 | H6H7

C → H6C | 9

D → H6H4 | H7H5 | H6H6 | H7H7

H0 → AH1
H1 → CD
H2 → Ae
H3 → AH7
H4 → DH6
H5 → DH7
H6 → 9
H7 → b

Answ

(6)

Remove unit production

$S \rightarrow ABCD \mid 0$

$A \rightarrow BC \mid 1$
$B \rightarrow C$
$C \rightarrow D$
$D \rightarrow d$

unit production: $B \rightarrow C$, $C \rightarrow D$

Remove $C \rightarrow D$ ⇒ $S \rightarrow ABCD \mid 0$

$A \rightarrow BC \mid 1$
$B \rightarrow C$
$C \rightarrow d$
$D \rightarrow d$

Remove $B \rightarrow C$ ⇒ $S \rightarrow ABCD \mid 0$

$A \rightarrow BC \mid 1$
$B \rightarrow d$
$C \rightarrow d$
$D \rightarrow d$

Equivalent gram :- $S \rightarrow ABCD \mid 0$
$A \rightarrow BC \mid 1$
$B \rightarrow d$
$C \rightarrow d$
$D \rightarrow d$

Answer