

JUNE						
M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Chomsky Normal Form (CNF)

→ Every CFG can be converted into CNF in which all production are of the form

$$A \rightarrow BC$$

$$A \rightarrow a$$

where A, B and C are non-terminals while 'a' is terminal

∴ left side has single α

∴ right side has ≤ 2 non-terminals or single terminal

Before converting CFG to CNF, we have to simplify it through three steps and then use the CNF method.

MONDAY 31
١٢ جمادى الثاني

TUESDAY 1
١٣ جمادى الثاني

- 1 - Need to eliminate useless production
- 2 - Need to eliminate Λ -production
- 3 - Need to eliminate unit production

Useless Production

Ex ①

$$S \rightarrow S/\Lambda$$

$$\downarrow$$

$$\boxed{S \rightarrow S}$$

$$S \rightarrow \Lambda$$

$$\downarrow$$

$$S \rightarrow \Lambda$$

∴ left & right is same in production

Ex ②

$$S \rightarrow AB/a$$

$$A \rightarrow b$$

} ⇒

$$\boxed{S \rightarrow AB}$$

$$S \rightarrow a$$

$$\boxed{A \rightarrow b}$$

} ⇒

$$S \rightarrow a$$

∴ S doesn't end on terminals

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28	29	30				

08

 Λ - Productions $(\therefore NT \rightarrow \Lambda)$

09

10

Ex-1

11

$$S \rightarrow aSa / bSb / \Lambda$$

12

 \Downarrow

01

$$S \rightarrow aSa$$

02

$$S \rightarrow bSb$$

03

$$S \rightarrow \Lambda$$

04

05

$$\Rightarrow S \rightarrow aSa / a'Sa'$$

 \therefore Double the "occurrence" of $NT \rightarrow \Lambda$ (direct or indirect)

Evening

$$S \rightarrow bSb / b'Sb'$$

$$\Rightarrow S \rightarrow aa / aSa$$

2 WEDNESDAY
١٨ جمادى الثاني

$$S \rightarrow bb / bSb$$

3 THURSDAY
١٩ جمادى الثاني

08

09

10

11

12

It is important to note that the new CFG generates all non- Λ words as does the old CFG and it generates no new/novel words that old CFG did not produce.

01

Ex-2

02

$$S \rightarrow CAB$$

03

$$A \rightarrow AaA$$

 $\therefore A \rightarrow \Lambda \neq B \rightarrow \Lambda$

04

$$A \rightarrow \Lambda$$

05

$$B \rightarrow bB$$

Evening

$$B \rightarrow \Lambda$$

$$C \rightarrow \exists$$

JUNE

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جمادى الثاني ١٣٣١

JUNE 2010

$$\Rightarrow S \rightarrow \overset{\circ}{C}\overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{C}\overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{C}\overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{C}\overset{\circ}{A}\overset{\circ}{B}$$

$$A \rightarrow \overset{\circ}{A}\overset{\circ}{a}\overset{\circ}{A} \mid \overset{\circ}{A}\overset{\circ}{a}\overset{\circ}{A} \mid \overset{\circ}{A}\overset{\circ}{a}\overset{\circ}{A} \mid \overset{\circ}{A}\overset{\circ}{a}\overset{\circ}{A}$$

$$B \rightarrow \overset{\circ}{b}\overset{\circ}{B} \mid \overset{\circ}{b}\overset{\circ}{B}$$

$$C \rightarrow \emptyset$$

$$\Rightarrow S \rightarrow c \mid cB \mid cA \mid CAB$$

$$A \rightarrow a \mid aA \mid Aa \mid AaA$$

$$B \rightarrow b \mid bB$$

$$C \rightarrow \emptyset$$

Ex-3

$$S \rightarrow XY$$

$$X \rightarrow zb$$

$$Y \rightarrow bW$$

$$Z \rightarrow AB$$

$$W \rightarrow z$$

$$A \rightarrow aA \mid bA \mid \Lambda$$

$$B \rightarrow Ba \mid Bb \mid \Lambda$$

$\therefore A \rightarrow \Lambda \ \& \ B \rightarrow \Lambda$
 which gives $z \rightarrow \Lambda$
 which gives $W \rightarrow \Lambda$

FRIDAY 4
 ٢٠ جمادى الثاني
 SUNDAY 6
 ٢٢ جمادى الثاني
 SATURDAY 5
 ٢١ جمادى الثاني

$$\Rightarrow S \rightarrow XY$$

$$X \rightarrow \overset{\circ}{z}\overset{\circ}{b} \mid \overset{\circ}{z}\overset{\circ}{b}$$

$$Y \rightarrow \overset{\circ}{b}\overset{\circ}{W} \mid \overset{\circ}{b}\overset{\circ}{W}$$

$$z \rightarrow \overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{A}\overset{\circ}{B} \mid \overset{\circ}{A}\overset{\circ}{B}$$

$$W \rightarrow \overset{\circ}{z} \mid \overset{\circ}{z}$$

$$A \rightarrow \overset{\circ}{a}\overset{\circ}{A} \mid \overset{\circ}{a}\overset{\circ}{A}$$

$$A \rightarrow \overset{\circ}{b}\overset{\circ}{A} \mid \overset{\circ}{b}\overset{\circ}{A}$$

$$B \rightarrow \overset{\circ}{B}\overset{\circ}{a} \mid \overset{\circ}{B}\overset{\circ}{a}$$

$$B \rightarrow \overset{\circ}{B}\overset{\circ}{b} \mid \overset{\circ}{B}\overset{\circ}{b}$$

JUNE						
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28	29	30				

08 $\Rightarrow S \rightarrow xy$
 09 $X \rightarrow b | z b$
 10 $Y \rightarrow b | bW$
 11 $Z \rightarrow B | A | AB$
 12 $W \rightarrow z$
 03 $A \rightarrow a | aA$
 04 $A \rightarrow b | bA$
 05 $B \rightarrow a | Ba$
 Evening $B \rightarrow b | Ba$

7 MONDAY
 جمادى الثاني ٢٣

H.W

$S \rightarrow xay | yy | ax | zyx$

8 TUESDAY
 جمادى الثاني ٢٤

$X \rightarrow za | bz | zz | yb$

08

09

$Y \rightarrow ya | xy | \Lambda$

10

11

$Z \rightarrow ax | yxyx$

12

Unit Production

N.T \rightarrow INT

Ex-1

Assume no. Λ -production

$S \rightarrow A/a$

$A \rightarrow b$

\Rightarrow

$S \rightarrow A$

$S \rightarrow a$

$A \rightarrow b$

\Rightarrow

$S \rightarrow b$

$S \rightarrow a$

$A \rightarrow b$

$\Rightarrow S \rightarrow a$
 $\Rightarrow S \rightarrow b \Rightarrow S \rightarrow a | b$

JUNE						
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جمادى الثاني ١٤٣١

JUNE 2010

Ex-2

$$S \rightarrow A | Aa$$

$$A \rightarrow b | bb$$

$$\Rightarrow \boxed{S \rightarrow A}^u$$

$$S \rightarrow Aa$$

$$A \rightarrow b$$

$$A \rightarrow bb$$

$$\therefore S \rightarrow A \rightarrow b \rightarrow bb$$

$$S \rightarrow b | bb$$

$$S \rightarrow Aa$$

$$A \rightarrow b$$

$$A \rightarrow bb$$

Ex-3

$$S \rightarrow B | a$$

$$B \rightarrow C | b$$

$$C \rightarrow d$$

$$\Rightarrow \boxed{S \rightarrow B}^u$$

$$S \rightarrow a$$

$$\boxed{B \rightarrow C}^u$$

$$B \rightarrow b$$

$$C \rightarrow d$$

$$S \rightarrow d | b$$

$$S \rightarrow a$$

$$B \rightarrow d | b$$

$$C \rightarrow d$$

WEDNESDAY 9
٢٥ جمادى الثاني

THURSDAY 10
٢٦ جمادى الثاني

Ex-4

$$S \rightarrow B | a$$

$$B \rightarrow C | b$$

$$C \rightarrow S | y$$

$$\Rightarrow \boxed{S \rightarrow B}^u$$

$$S \rightarrow a$$

$$\boxed{B \rightarrow C}^u$$

$$B \rightarrow b$$

$$\boxed{C \rightarrow S}^u$$

$$C \rightarrow y$$

$$S \rightarrow b | y | a$$

$$\boxed{S \rightarrow a}^{u, l}$$

$$B \rightarrow y | a$$

$$B \rightarrow b$$

$$C \rightarrow a | b$$

$$C \rightarrow y$$

Evening

جمادى الثاني ١٤٣١

JUNE 2010

JUNE						
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	29	30				

CNF :-

- 1- No Λ -productions
- 2- No unit productions
- 3- No useless productions

All productions must be of form

$$NT \rightarrow NT \ NT$$

$$NT \rightarrow t$$

Example

Evening

$$S \rightarrow ABCD$$

$$S \rightarrow a$$

$$S \rightarrow ab$$

11 FRIDAY
٢٤ جمادى الثاني

$$S \rightarrow Ab$$

12 SATURDAY 13 SUNDAY
٢٨ جمادى الثاني ٢٩ جمادى الثاني

$$B \rightarrow a$$

$$C \rightarrow c$$

$$D \rightarrow d$$

$$A \rightarrow d$$

① and ③ are already satisfied.

$$S \rightarrow AX_1$$

$$S \rightarrow AX_4$$

$$X_1 \rightarrow BX_2$$

$$B \rightarrow a$$

$$X_2 \rightarrow CD$$

$$C \rightarrow c$$

$$S \rightarrow a$$

$$D \rightarrow d$$

$$S \rightarrow X_3 X_4$$

$$A \rightarrow d$$

Evening

$$X_3 \rightarrow a$$

$$X_4 \rightarrow b$$

JUNE						
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رجب ۱۴۳۱

JUNE 2010

(H.W)

Convert into CNF

$$S \rightarrow bA/aB$$

$$A \rightarrow bAA/aS/a$$

$$B \rightarrow aBB/bS/b$$

(H.W) Convert into CNF

$$S \rightarrow A/bb$$

$$A \rightarrow B/b$$

$$B \rightarrow S/a$$

It is pertinent to note that resulting CNF grammar is a binary tree.

MONDAY 14
ارجب ۱۴

TUESDAY 15
ارجب ۲ ۱۵

Assignment No. 3

6.2, 6.4, 6.6, 6.11, 6.12, 6.14, 6.21, 6.22, 6.34
6.35, 6.39^B, 6.36

highlighted questions are for those people who did not appear in quiz (previous one quiz)