

DEPT.

CLASS

DIV

ROLL NO.

DATE

SUBJECT \_\_\_\_\_

Questions	1	2	3	4	5	6	7	8	Total
Marks obtained									

Examiner

-Unit III

## Content Free Grammar

## List of Problems for Practice

Q. ①

Def<sup>n</sup>

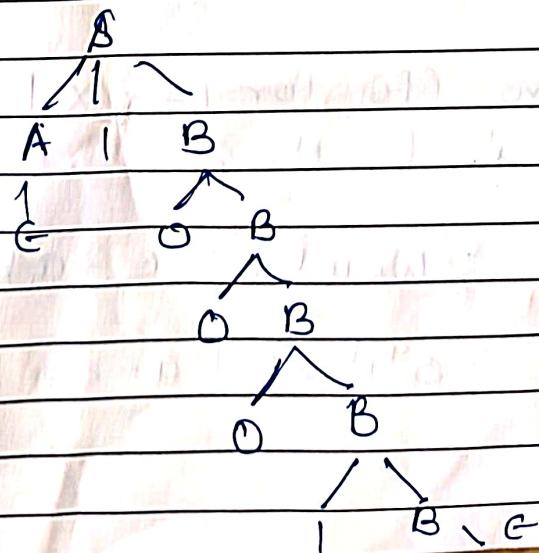
- ① CFG
- ② Ambiguous Grammar
- ③ Unambiguous Grammar

e.g. 1 Give Left most Derivation, Rightmost Derivation and Parse tree for following grammars.

$$\textcircled{1} \quad S \rightarrow AIB, \quad A \rightarrow OA \quad \text{LMD} \quad E \xrightarrow{\text{RMD}} B \xrightarrow{\text{RMD}} OB \mid 1B \mid G \quad "1001"$$

$$\begin{array}{ll} \textcircled{2} \quad S \rightarrow AIB & S \rightarrow AIB \\ \Rightarrow AIB & \Rightarrow A1OB \\ \Rightarrow 1OB & \Rightarrow A10OB \\ \Rightarrow 1OB & \Rightarrow A100OB \\ \Rightarrow 100IB & \Rightarrow A1001B \\ \Rightarrow 100IB & \Rightarrow A1001G \\ \Rightarrow 1001 & \Rightarrow E1001 \\ \Rightarrow 1001 & \Rightarrow 1001 \end{array}$$

## Parse Tree



$$\textcircled{2} \quad S \rightarrow XY, \quad Y \rightarrow YY|b \quad X \rightarrow YY|q$$

(3)  $E \rightarrow E + T \mid T$   
 $T \rightarrow T * F \mid F$   
 $F \rightarrow (E) \mid a \mid b$

Q-2 Give CFG for following lang.

$$L = \{a^i b^j \mid i \leq j \leq 2i, i \geq 1\}.$$

$$\textcircled{2} \quad 0(0+1)^*01(0+1)^*1$$

$$(0+1)^* (1+(01)^*)$$

$$④ L = \{ a^i b^j c^q ; i+j=q, i, j \geq 1 \}$$

$$⑤ L = \{ a^i b^j c^k \mid i \neq j + k \}$$

✓ 6 L = {a<sup>i</sup>b<sup>j</sup>c<sup>k</sup> | i=j or j=k?}

$$(7) \quad 1 = \sum_{j=0}^i \binom{j}{k} \quad j > i+k$$

8 Give CFG for matching Parenthesis

⑨ CFG for  $L = \{a^n b^m c^n \mid m, n \geq 1\}$

10 Give CFG for  $L = \{x \mid x \text{ contains equal no. of a's \& b's}\}$

$$L = \{ w c w^T \mid w \in \{a, b\}^*\}$$

12)  $L = \{0^a 1^b 2^c \mid a - c = b\}$

Q. 3\* Show grammar is ambiguous

①  $E \rightarrow E+E \mid E \cdot E \mid (E) \mid I$   
 $I \rightarrow a \mid b$

- (a) Show Grammar is ambiguous  
(b) Remove Ambiguity

② Give ambiguous grammar for "if - then - else" statement & write unambiguous grammar for it.

③  $S \rightarrow SS \mid (S) \mid \epsilon$

- (a) Show ambiguous      (b) Remove Ambiguity

④ Is it ambiguous?

$$S \rightarrow aB \mid ab \quad A \rightarrow aAB \mid aA \quad B \rightarrow ABb \mid b$$

⑤  $S \rightarrow aAS \mid a$   
 $A \rightarrow SbA \mid SS \mid ba$  } Is ambiguous?

⑥  $S \rightarrow as \mid \epsilon \quad S \rightarrow asbs$

- (a) is ambiguous      (b) if then remove ambiguity

⑦  $S \rightarrow aB \mid bA \quad A \rightarrow aas \mid bAA$   
 $B \rightarrow b \mid bs \mid aBB$

For string "aababbabba" find

- (a) LMD      (b) RMD      (c) Parse Tree      (d) Is it ambiguous.

(8)  $S \rightarrow SS \mid a \mid b$

(9)  $S \rightarrow ABA \mid A \rightarrow aA \mid G \mid B \rightarrow bB \mid G$

(10)  $S \rightarrow aSb \mid aaSb \mid G$

(11)  $G = (V = \{E, F\}, T = \{a, b, -\}, E, P)$

P is

$E \rightarrow F, E \rightarrow F-F, F \rightarrow a, E \rightarrow E-F, F \rightarrow b$

(a) is it Ambiguous

(b) Remove Ambiguity

Q.4 Simplify the grammar

(1) (a) Find Non-generating symbols in the grammar

$S \rightarrow AB \mid CA$

$A \rightarrow a$

$B \rightarrow BC \mid AB$

$C \rightarrow aB \mid b$

(2) Find Non-reachable Symbols

$S \rightarrow aBa \mid BC$

$A \rightarrow ac \mid BCC$

$C \rightarrow a$

$B \rightarrow bCC, D \rightarrow E, E \rightarrow d$

(3) Simplify the following grammar

$\Rightarrow S \rightarrow ASB \mid G$

$A \rightarrow aAS \mid a$

$B \rightarrow SBS \mid A \mid bb$

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(2)  $S \Rightarrow \emptyset | A \emptyset | B \emptyset | BB$

$$A \rightarrow C$$

$$B \rightarrow S | A$$

$$C \rightarrow S | e$$

(3)  $S \Rightarrow Ab, A \rightarrow a, B \rightarrow C \emptyset | b, C \rightarrow D, D \rightarrow E, E \rightarrow a$

Q.5 Convert to Chomsky Normal Form (CNF)

(1)  $S \rightarrow aAbB \quad A \rightarrow aP \quad B \rightarrow bB \emptyset | b$

(2)  $S \rightarrow PQP \quad P \rightarrow OP | G \quad Q \rightarrow lQ | e$

(3)  $S \rightarrow bA \emptyset | ab \quad A \rightarrow bAA \emptyset | as | a \quad B \rightarrow aBB \emptyset | bs \emptyset | b$

(4)  $S \rightarrow Aba, S \rightarrow aab, B \rightarrow A \emptyset | Ac$

Q.6. Convert to Greibach Normal Form (GNF)

(1)  $S \rightarrow AA \emptyset | a \quad A \rightarrow SS \emptyset | b$

(2)  $E \rightarrow ETT \emptyset | T$

$$T \rightarrow T * F \emptyset | F$$

$$F \rightarrow a$$

(3)  $S \rightarrow AB, A \rightarrow Bs \emptyset | b \quad B \rightarrow SA \emptyset | b$

(4)  $A_1 \rightarrow A_2 A_3, A_2 \rightarrow A_3 A_1 \emptyset | b, A_3 \rightarrow A_1 A_2 \emptyset | a$

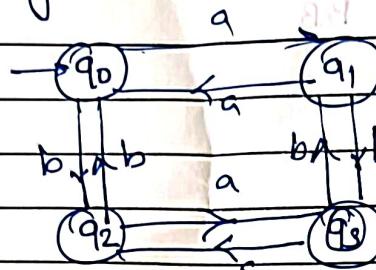
Q.7

Write short note on Chomsky classification or Hierarchy.

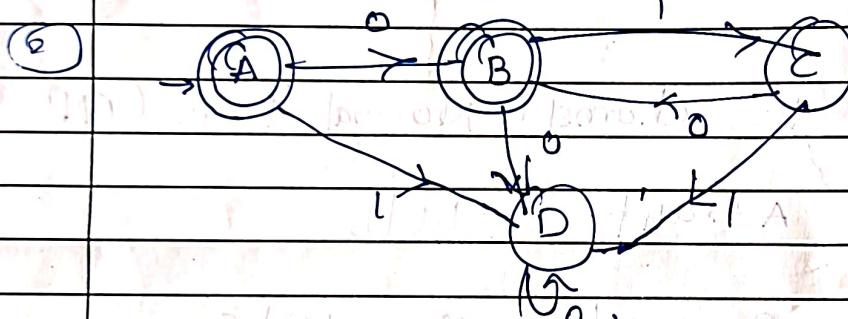
Q.8

Convert Following

(1) Give Right Linear Grammar (RLG) for DFA



(2)



Q.9

Convert RLG to DFA

(3)

$S \rightarrow bB$ ,  $B \rightarrow bC$ ,  $A \rightarrow B$ ,  $B \rightarrow aB$ ,  $C \rightarrow a$ ,  $B \rightarrow b$

(4)

$S \rightarrow 0A|1B$

$A \rightarrow 0C|1A|0$

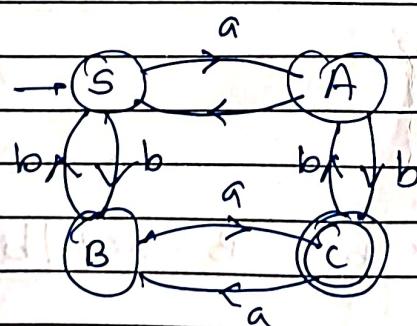
$B \rightarrow 1B|1A|1$

$C \rightarrow 0|0A$

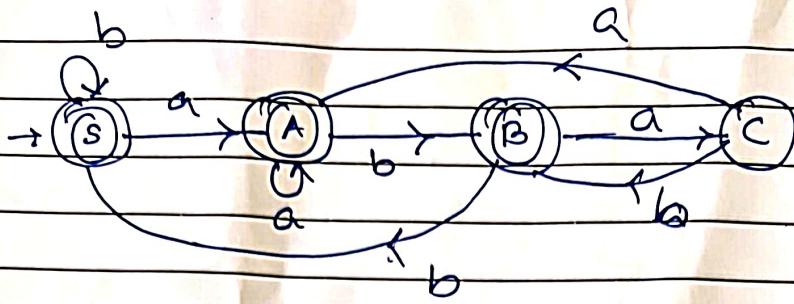
Q.10

Convert DFA to LLG

(1)



Q. 2



Q. 11

LLG to DFA

①  ~~$S \rightarrow eA | Bb , C \rightarrow Bb | B \rightarrow Bb/b$~~

②.

②  $S \rightarrow B1 | A0 | C0 , B \rightarrow B1 | I , A \rightarrow A1 | B1 | C0 | 0$   
 $C \rightarrow A0$

Q. 12

RLG to LLG

①  $S \rightarrow bB | b , B \rightarrow bC | ab | b , C \rightarrow a$

②  $S \rightarrow OA | IB , A \rightarrow OC | IA | O , B \rightarrow IB | IA | I$   
 $C \rightarrow O | OA$

Q. 13

LLG to RLG

$S \rightarrow CO | AO | BI$

$A \rightarrow AI | CO | BI | O$

$B \rightarrow BI | I , C \rightarrow AO$

Q. 14

write short not on.

CFL closed under ① Union ~~②~~  
 ② concatenation ③ Kleene star