Theory of Automata

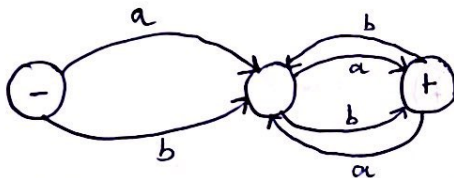Roll Number: 20F-0336
Name: Ahmed Kasteer
Section: 6C

Q1:-

1. Even $(aa + ab + ba + bb + bc + cb + ac + ca + cc)^*$
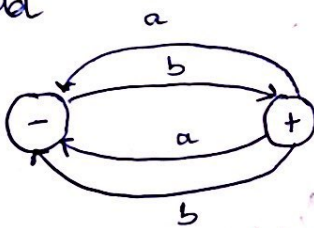
2. ODD $(a + b + c)(aa + ab + ba + bb + bc + cb + ac + ca + cc)^* +$
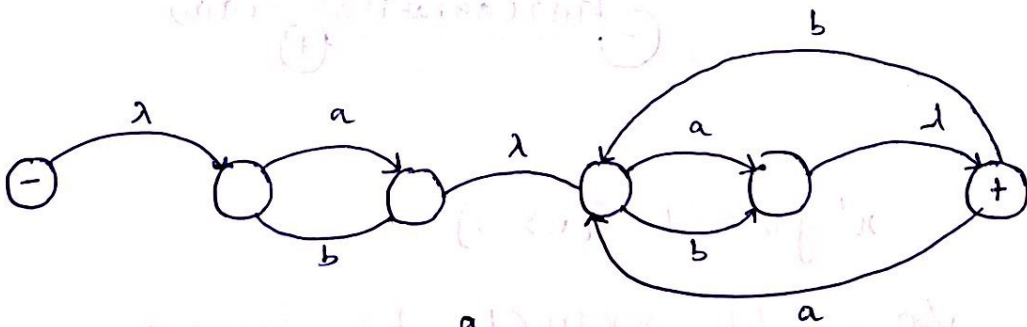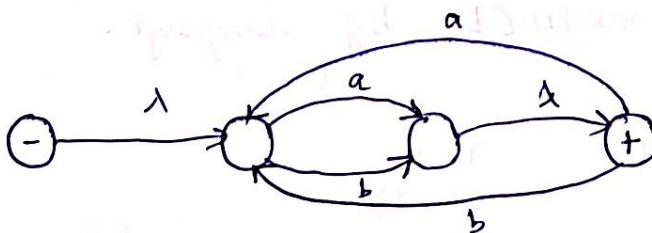 $(aa + ab + ba + bb + bc + cb + ac + ca + cc)^* (a + b + c)$

Q2:-

1. Even

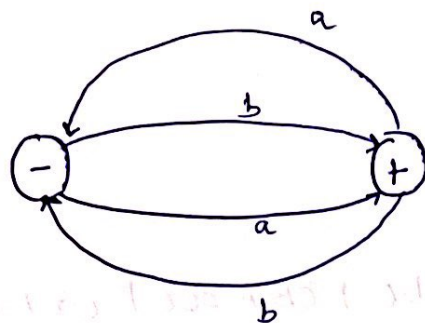2. odd

Q3:-

1.

2.

②

Q4:-

DFA

Step 1:-

Step 2:-

Step 3:-

$(a+b)(aa+ab+ba+bb)^*(a+b)$
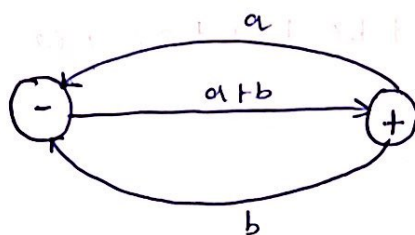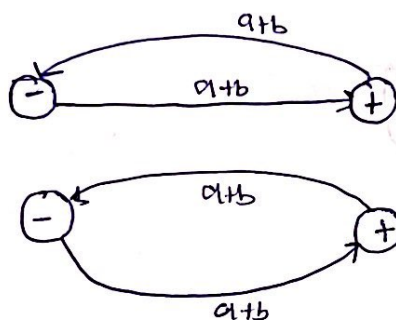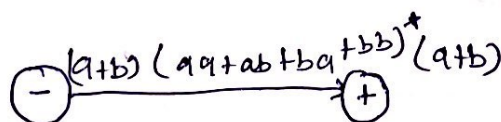
Q5:-

$x^n y^{n^2} n = L \quad (n >= 1)$

So   let $xxyn \in L$ by language

Now, let $a = x$
                $b = xy$
                $c = n$
        $L = abc$
     pumping on b
        $abbc$
        $x\ xy\ xy\ n$
     non context free.

Q6:-

$$a^n b^n ab^{n+1}$$

$$w: a^m b^m ab^{m+1} \qquad \forall \; m \; \geq = n$$

$$w = \underbrace{aa \ldots\ldots m \text{ times}}_{x} \; \underbrace{b, \ldots\ldots m \text{ times}}_{} \; \underbrace{a}_{y} \underbrace{b \ldots\ldots m+1}_{z}$$

$$xyz = a^m b^m \, ab^{m+1}$$

$$xyyz = a^m b^m \, aa \, b^{m+1}$$

a one more time

not regular

Q7:-

$$S \rightarrow aSa \; / \; bSb / a / b$$
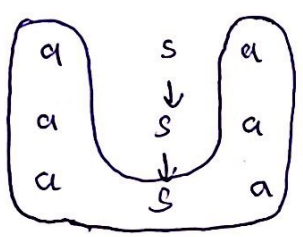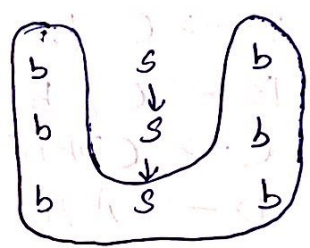
$$a\,a\,a\,S\,a\,a\,a \qquad\qquad bbb\,S\,bbb$$

forms a palindrome.

Q8:-

$$S \rightarrow AAA \; / B$$
$$A \rightarrow aA \; / B$$
$$B \rightarrow \lambda$$

<u>Remove Null</u>

$$S \rightarrow AAA \; / \; \lambda$$
$$A \rightarrow aA \; / \; \lambda$$

$$S \rightarrow AAA \; / \; AA / A$$
$$A \rightarrow aA \; / a$$

Unit Production

S — A

S — AAA / aA / a / AA

A —> aA / a

CNF

S —> A AA / TaA / a / AA

A —> TaA / a

Ta —> a

Q9.-

S —> aAa / bBb / e

A —> C / a

B —> C / b

C —> CDE / e

D —> A / B / ab

Unit Production:-

S —> aAa / aca / bBb / bcb / e

A —> a

B —> b

C —> CDE / e

D —> A / B / ab / c

S —> aAa / aca / bBb / bcb / e

A —> a

B —> b

C —> CDE / CAE / CBE / CCE / e

D —> ab

CFC,

S $\rightarrow$ AAA/ACA/BBB/BCB/e
A $\rightarrow$ a
B $\rightarrow$ b
C $\rightarrow$ CDE/CAE/CBE/CCE/e
D $\rightarrow$ AB

CFG:-

S $\rightarrow$ Ax /AY/BZ /Bx,/e
A $\rightarrow$ a
B $\rightarrow$ b
C $\rightarrow$ CY, /CZ, / C /x₂/CY₂/e
D $\rightarrow$ AB
X $\rightarrow$ AA
Y $\rightarrow$ CA
Z $\rightarrow$ BB
$x_1 \rightarrow$ CB
$y_1 \rightarrow$ DE
$z_1 \rightarrow$ AE
$x_2 \rightarrow$ BE
$y_2 \rightarrow$ CE

Q10:- S $\rightarrow$ AA/BB/C
A $\rightarrow$ AS/AA
B $\rightarrow$ B/A
C $\rightarrow$ AB
$\boxed{B \rightarrow B}$

S $-$ AA/BB/C
A $\rightarrow$ AS/AA
B $\rightarrow$ A
C $\rightarrow$ AB
$\boxed{B \rightarrow A}$

$S \rightarrow AA / BBB / C$

$A \rightarrow AS / AA$

$C \rightarrow AB / AA$

$\boxed{S \rightarrow C}$

$S \rightarrow AA / BB$

$A \rightarrow AS / AC / AA$

$C \rightarrow AB / AA$

Q11:-

$S \rightarrow CA / BB$

$B \rightarrow b / SB$

$C \rightarrow b$

$A \rightarrow a$

GNF

$Z \rightarrow AZ / A / BZ / B$

$B \rightarrow bz_1 / b$

$Z_1 \rightarrow BZ_1 / B$

$C \rightarrow b$

$A \rightarrow a$

Q NO 12:-

- one terminal or non-terminals followed by atleast one terminal

- two non-terminals but also followed by atleast one terminal

Example:-

$S \rightarrow aB / aA / AB$
$A \rightarrow Aa / AB / a$
$B \rightarrow b$

$S \rightarrow aB / aA / AB$
$A \rightarrow az / a$
$z \rightarrow az / a / Bz / B$
$B \rightarrow b$

$\llcorner$ Correct linear Grammar