SMRITI DUHAN
2K17/MCE/087

ASSIGNMENT 2

THEORY OF COMPUTATION

(1) chomsky classified the grammer into Four types in terms of production (0-3)

In production of the form $\phi A \psi \rightarrow \phi \alpha \psi$, where A is a variable ϕ is called the left content, ψ is the right context and $\phi \alpha \psi$ is replacement string

Type 0

let G be type 0 grammar This we can find an Equivalent grammar in which each production and eith of the form $\alpha \rightarrow \beta$ and β string of variables only, or of the form $A \rightarrow \alpha$ where A is variable and is a terminal

Type 1

A grammar Is called type 1 or context sensitive if all the production are type 1 production. The production $S \rightarrow \Lambda$ is also allowed in type 1 grammar but in this case S does not appear in the right hand side of any production.

$A \rightarrow abA$ is a type 1 production. both left and right contents are Λ

Type II

A grammar is called a type 2 grammer if it contain only type 2 production. It is also called a context for grammer as A can be replaced by α in any context

A language Created by a context for grammar is called type 2 ~~production~~ language or context for language. A type 2 production is in the form $A \rightarrow \alpha$ wher $A \in V_n$ and $\alpha \in (V_n \cup \Sigma)$

In the other words L.H.S has no context a left Content

Eg → $S \rightarrow Aa$, $A \rightarrow a$, $B \rightarrow abc$

Type III

A production of the form $A \rightarrow a$ or $A \rightarrow ab$ where A, $B \in V_n$ and $a \in \Sigma$ is called type 3 production.

A grammar is called a type 3 regular grammar if all it's production are type 3 production.
Eg:- $S \to \Lambda$ production, $S \to aS$ In this case does not A appear in RHS of any production.

$w_1 = \{0S1, 0A, 0, 1B, 1\}$

$w_2 = \{0S1, 00, 00A, 0, 11B, 11, 1\}$

(2) To test weather

$001100 \in L(G)$

$w = 001100 \Rightarrow |w| = 6$

$w_0 = \{S\}$

$w_1 = \{0S1, 0A, 0, S, 1B, 1\}$

$w_2 = \{0, 1, 0S1, S, 0A, 1B\}$

$w_3 = \{00S1, 00A1, 001, 01B1, 011, 00A, 00, 11B, 11, 1\}$,

$w_3 = \{000S11, 000B1, 001B1, 0011, 001$ ~~00A, 00, 11B, 11, 1~~ $, 000A1, 0013$
$011, 000A, 00, 111B, 111, 11, 1\}$

$w_4 = \{00011, 000111, 000001, 001111, 0011, 0001, 001, 01111, 01111$
$, 011, 00000A, 00, 11111B, 00000, 11111, 1111, 111, 11, 1\}$

$w_5 = \{000011, 000111, 000001, 001111, 010111, 0011, 001, 01111, 01111, 011, 00$
$000A, 00, 11111B, 00000, 11111, 1111, 111, 1\}$

$w_6 = \{000011, 000111, 000001, 001111, 00111, 0011, 001, 01111, 0111, 011,$
$000000, 00, 111111, 00000, 11111, 0000, 11111, 1111, 111, 11, 1\}$

$w_1 = \{w_6\}$

$\therefore 001100 \notin w_6 \; \varepsilon \; 001010 \notin w_6$ also

$01010 \notin w_6$

$\Rightarrow$ 001100, 001010 & 01010 are not generated by the given grammer.

(3) Type 2 grammar are used to context- for grammar (as A can be replaced by α or in any context from the product $A \alpha \alpha$), where $A \in V_N$ and $\alpha \in (V_N V_T)$

one possible context for grammer combining future as many error as ones can be

$S \to 0S0S1S \mid 0S1 \mid S0S1 \mid S0S0S$.

(4) a) $\{a^2, a^5, a^8 \ldots\} = a(aaa)^n$

b) $\{w \in \{a,b\} \mid$ have only one $a\} = b^*ab^*$

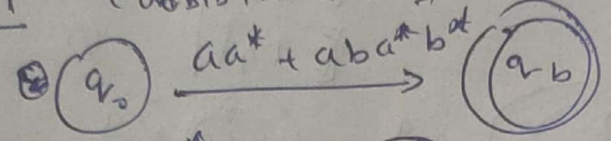
c) $\{a^n \mid n$ is divisible by $2, 3$ or $n=5\}$.

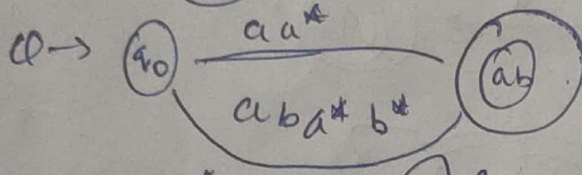
$= (aa)^* + (aaa)^*$

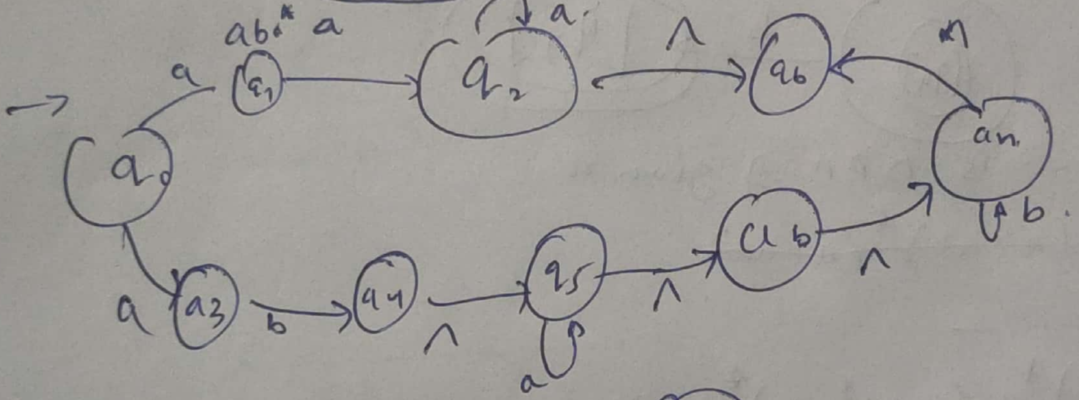
d) Set of all thing over (a,b) begining and ending with $a = a(a+b^*)a$.

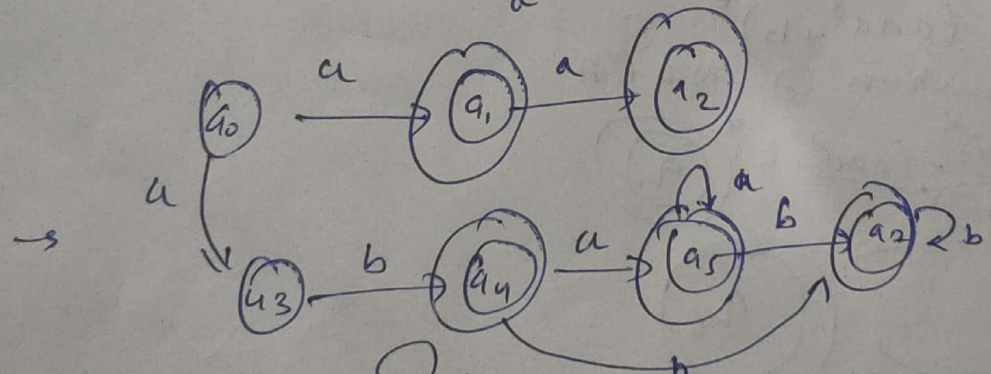
(5) a) $aa^* + aba^*b^*$

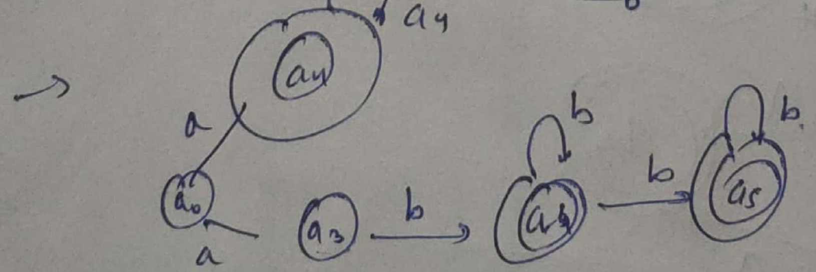
Step 1 (construction of NDFA)











Step 2: Construct the DFA

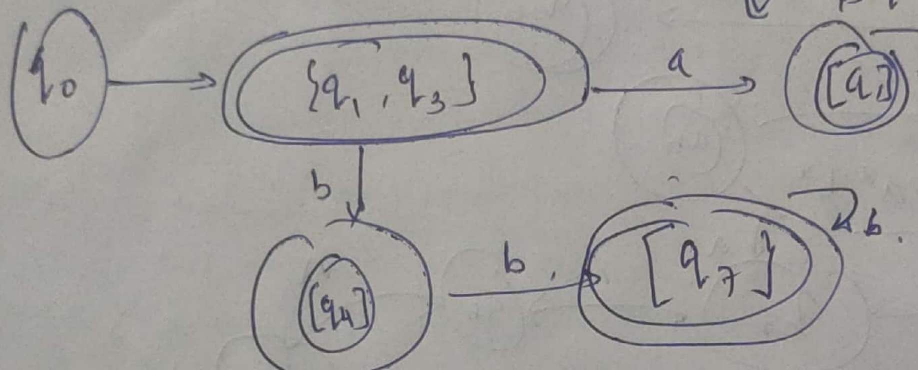
corresponding the above NDFA, we can creat table

state	a	b
q_0	q_1, q_3	—
q_1	q_1	—
q_3	—	q_4
q_4	q_4	q_2
q_7	—	q_2

The other table can be controlled.

Q	Qa	Qb
$[q_0]$	$[q_1, q_3]$	ϕ
$[q_1, q_3]$	$[q_1]$	$[q_4]$
$[q_1]$	$[q_1]$	ϕ
$[q_4]$	$[q_4]$	$[q_0]$
$[q_7]$	ϕ	$[q_7]$

10.



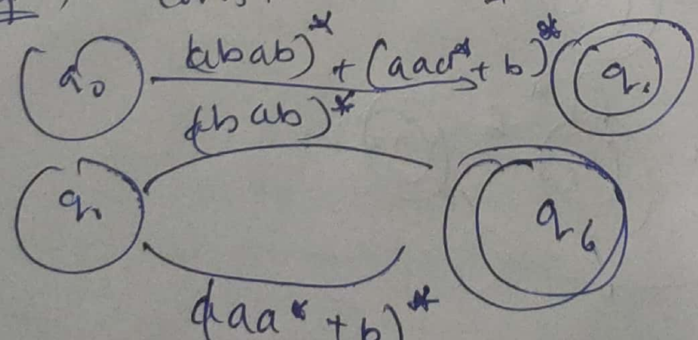
the above is DFA of given re

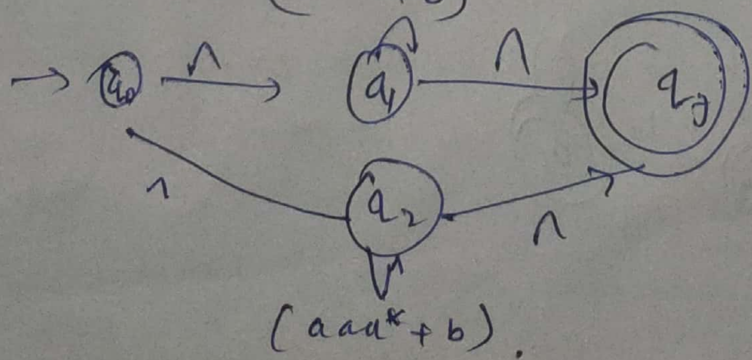
~~b) ab(a+ab)* (a+aa)~~

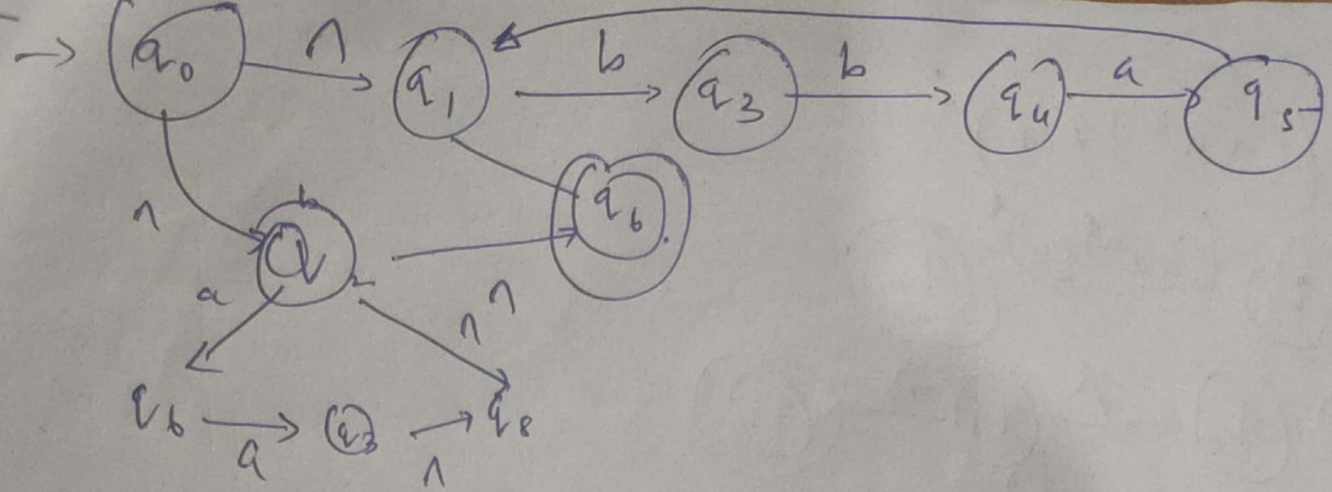
Q.b — — —

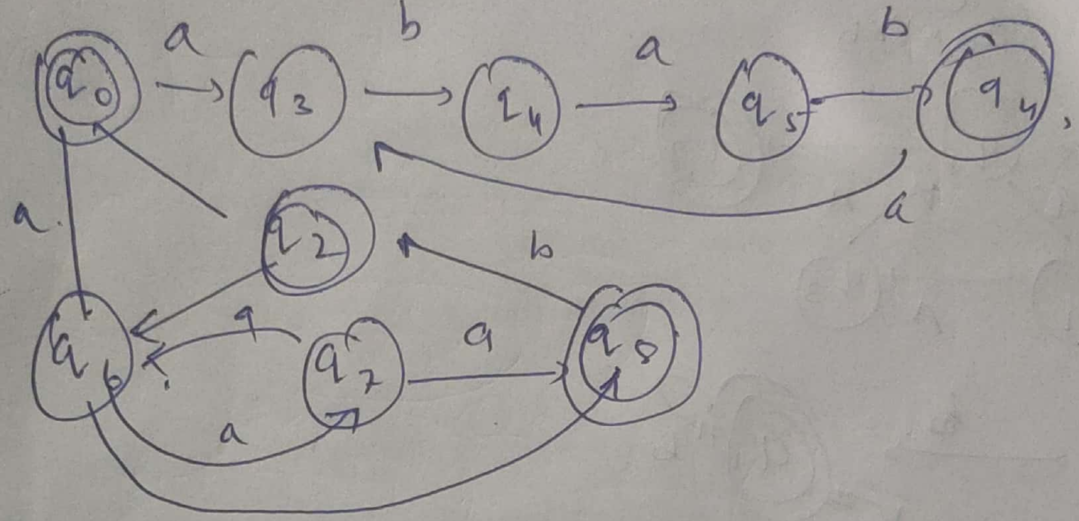
$(abab)^* + (aaa^* + b)^*$

Step-1 Construction of NDFA









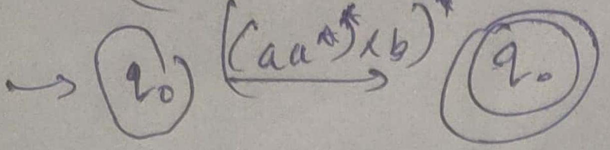
step II construction of DFA

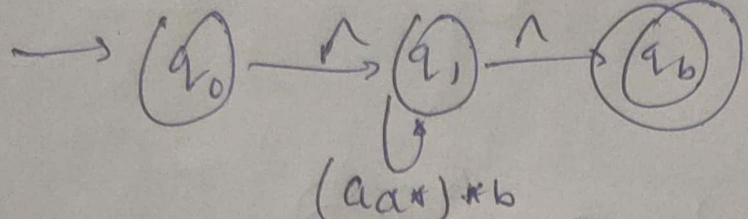
the table is given,

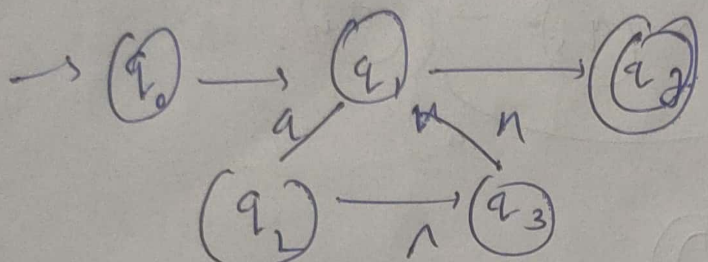
states	a	b
→ q_0	$q_1 q_6$	q_2
→ q_1	q_3	–
→ q_2	q_6	q_2
q_3	–	q_4
q_4	q_5	–
q_5	–	q_1
q_6	–	q_1
→ q_7	$q_6 q_6$	q_2
→ q_8	$q_6 q_1$	q_2

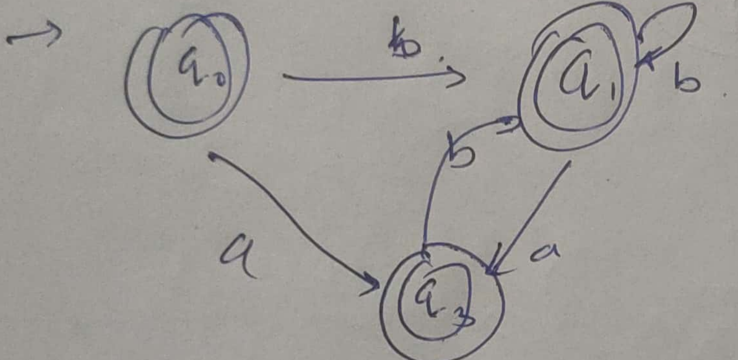
Q —— ——

$[(aa^*)^*(b)]^*$









Q — ——

(a) $\{a^n : n \geq 0 \; n \neq 4\}$

for this we can Easily write a regular Expression

as $\Lambda * a * aa * aaa + aaaaa^*$

Hence it is a regular set.

(b) $\{a^n : n$ is Either ~~bmul~~triple of 3 or 5$\}$

for this set we can write as

$(aaa)(aaa)^* + aaaaa(aaaaa)^*$