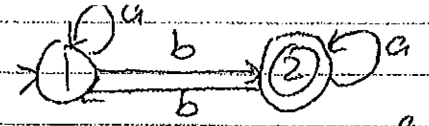
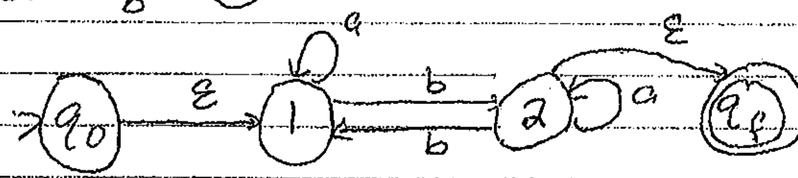
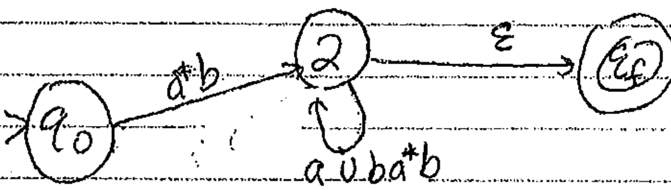
9) D_1:



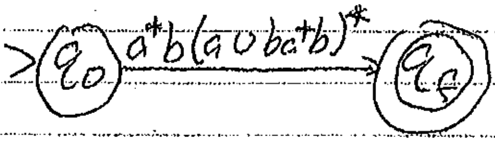
GNFA-4:



RIP out 1:

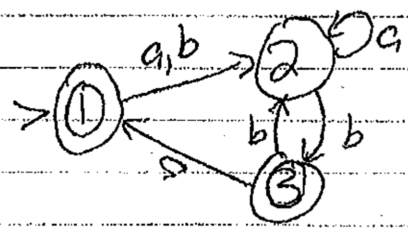


9 cont) RIP out 2:

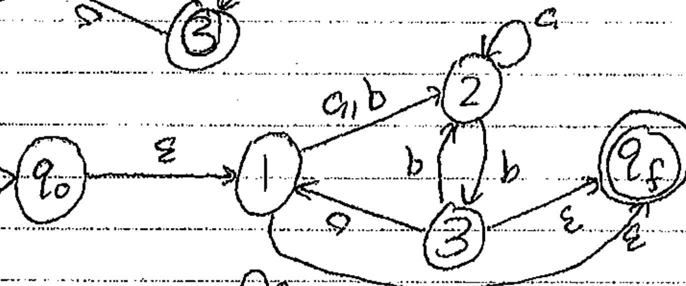


Thus a R.E. that expresses the same language as D_1 is $\boxed{a^*b(a \cup ba^*b)^*}$

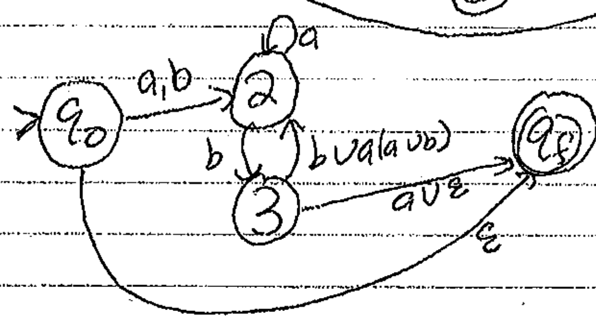
D_2:



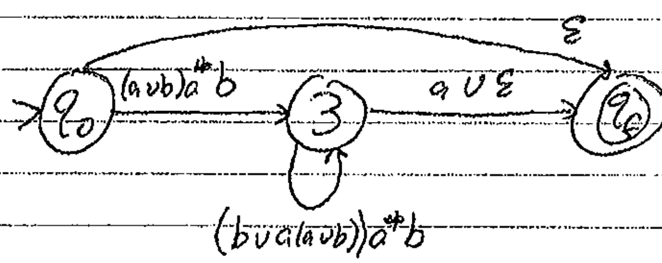
GNFA-5:



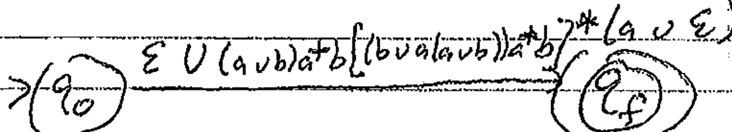
RIP out 1:



RIP out 2:

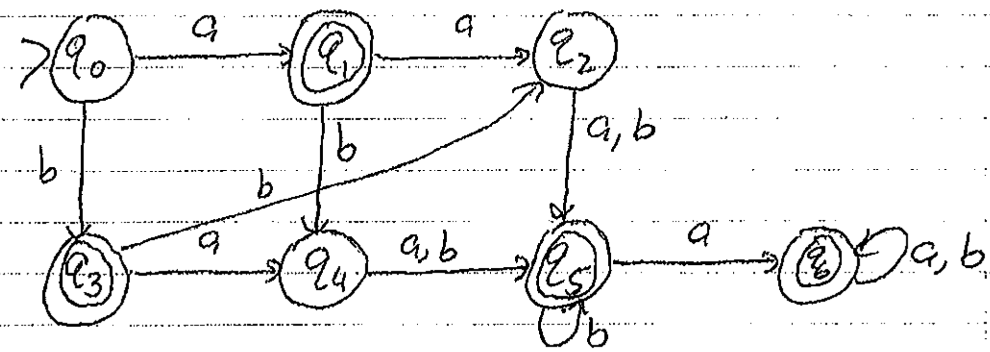


RIP out 3:



Final R.E.: $\boxed{\varepsilon \cup (a \cup b)a^*b\left[(b \cup a(a \cup b))a^*b\right]^*(a \cup \varepsilon)}$

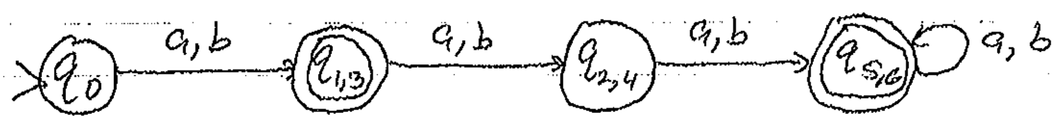
12) Here is a drawing of the original DFA:



<u>Algorithm</u>

$[0,2]$	$S[1,5] = \{[0,2]\}$, on a
	$S[3,5] = \{[0,2]\}$, on b
$[0,4]$	$S[1,5] = \{[0,2],[0,4]\}$ on a
	$S[3,5] = \{[0,2],[0,4]\}$ on b
$[1,3]$	$S[2,4] = \{[1,3]\}$ on a, b
$[1,5]$	$D[1,5] = 1$ by a.
	$D[0,2] = 1$ recursively
	$D[0,4] = 1$ recursively
$[1,6]$	$D[1,6] = 1$ by a.
$[2,4]$	no action
$[3,5]$	$D[3,5] = 1$ by a.
$[3,6]$	$D[3,6] = 1$ by a.
$[5,6]$	no action

Thus the states that can "stay together" are $\{q_1, q_3\}$, $\{q_2, q_4\}$, and $\{q_5, q_6\}$.
Here is the minimized DFA:



This is the language of the set of strings with length 1, or 3 or more.