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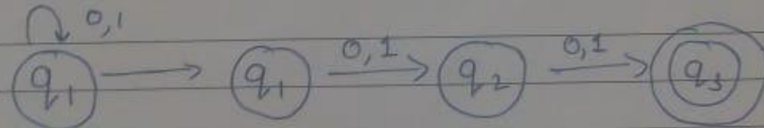
Part - A

1) aabbabbabbaaaabbab, two substrings are present

3) Equivalence of Moore and Mealy Machines -:
The equivalence of Moore and Mealy machines means both the machines generate the same output string for same input string.

We can not directly convert Moore machine to its equivalent mealy machine because the length of the moore machine is one longer than the Mealy machine for the given input.

4)



$w = 0011$

① $\hat{\delta}(q_0, \epsilon) = q_0$ Basic

② $\hat{\delta}(q_0, 0) = \hat{\delta}(q_0, \epsilon_0) = \hat{\delta}(\hat{\delta}(q_0, \epsilon)), 0) = \delta(q_0, 0)$
$= \{q_0\}$

③ $\hat{\delta}(q_0, 00) = \hat{\delta}(q_0, 0) = \{q_0\}$

④ $\hat{\delta}(q_0, 001) = \hat{\delta}(q_0, 1) = \{q_0, q_1\}$

⑤ $\hat{\delta}(q_0, 0011) = \hat{\delta}(q_0, 1) \vee \hat{\delta}(q_1, 1)$
$= q_0 \cup q_2 = \{q_0\, q_2\}$

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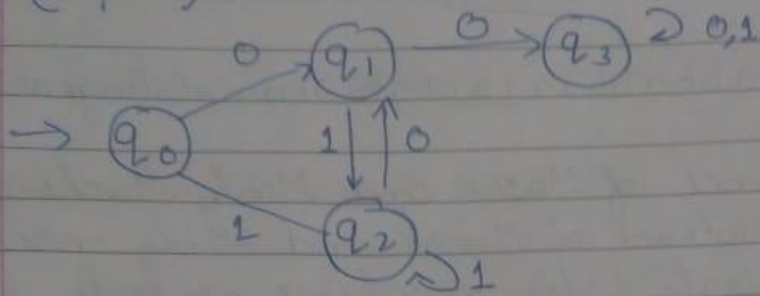
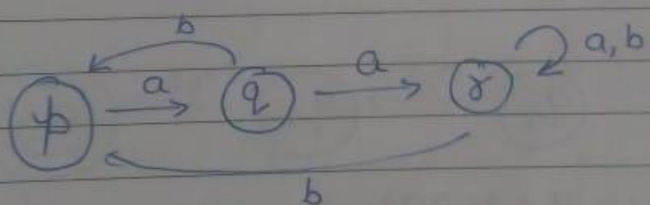
5) $(1 \mid 01)+$



2)

given

	a	b
$\rightarrow p *$	q	r
q	r	p
r	r	r



Language $= \{\varepsilon, ab, abab, abab .. \}$

$(ab)^+$

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Part - B

9) $(RS+R)^* R = R(SR+R)^*$

From LHS, $(RS+R)^*$ uses to generate any combinations of RS and R including ∧ epsilon.

Some example strings are :-

{ ∧, RS, RSRS, RRRS, RSR, ... }

Strings always starts from R but can end with either S or R. We can describe in English: R can appear in any combination where S is always followed by one R (two consecutive S is not possible).

And complete LHS $(RS+R)^*R$ means string always terminate with R.

Now consider following examples :-

1. R+S is same as S+R, it is basically union.

2. But RS can't be written as SR, order is important in concatenation.

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3. $(RS)R$ can be written as $R(SR)$.

4. $(RS)^*R$ can be written as $R(SR)^*$ both are same that is RSRSRS.....SR.

5. $(AB+A)$ can be written as $A(B+C)$.

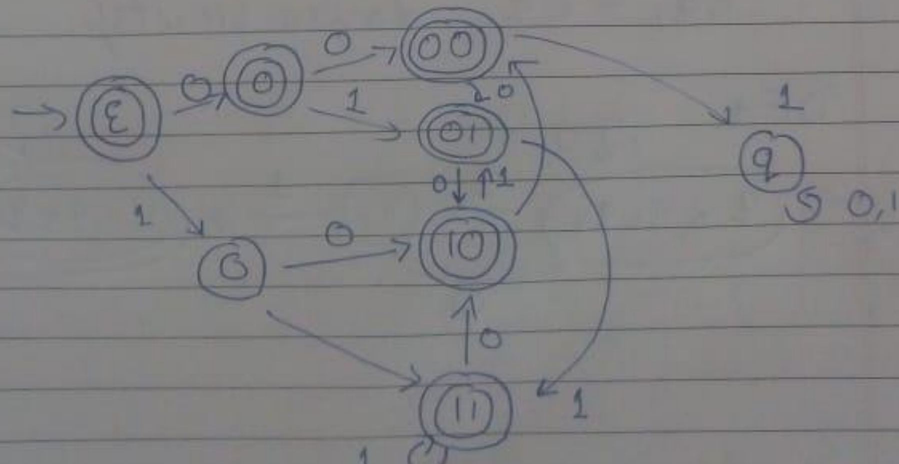
6. $(AB+A)$ can be written as $A(B+\Lambda)$. this is because $A = \Lambda A = A\Lambda$

7. $(BA+A)$ can be written as $(B+\Lambda)A$.

<u>Formal Proof</u>-:

$$(RS+R)^*R$$
$$(R(S+\Lambda))^*R$$
$$\Rightarrow R((S+\Lambda)R)^*$$
$$\Rightarrow R(SR+R)^*$$
$$= RHS$$

6)



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8) Minimize the following DFA –:

	0	1
q_0	q_2	q_1
q_1	q_4	q_3
q_2	q_2	q_1
q_3	q_5	q_6
q_4	q_2	q_1
q_5	q_6	q_5
q_6	q_6	q_5

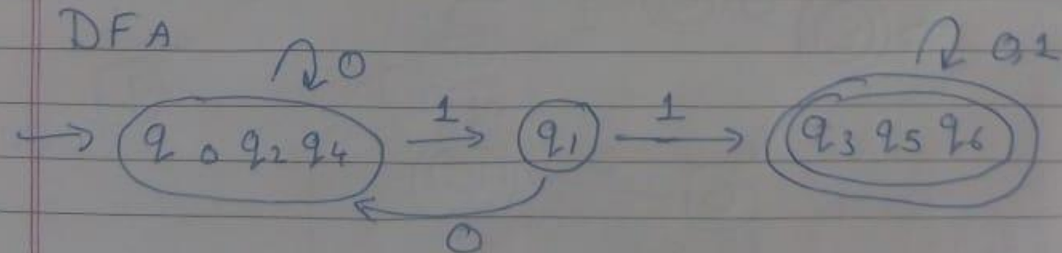
Equivalent $= \{q_0, q_1, q_2, q_4\}\{q_3, q_5, q_6\}$

$= \{q_0, q_2, q_1\}\{q_1\}\{q_3\ q_5\ q_6\}$

$\{q_0 q_2\ q_4\}\ \{q_1\}\{q_3\ \ q_5\ q_6\}$

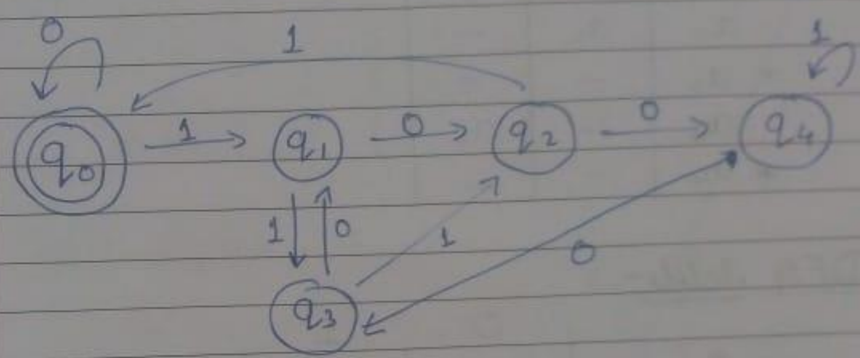
$\therefore\ Eq_1 = Eq_2$ so here we stop

DFA



Part-C

10)
a)



Here the total ~~no~~ number of edges are -

$10 = = Q \times \Sigma = 5 \times 2$

It is a complete DFA that can accept all possible binary strings those decimal equivalent is divisible by 5.

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10) b) NFA into DFA :-

NFA table :-

	0	1
→ q_0	q_0q_1	q_0q_3
q_1	q_2	–
* q_2	–	–
q_3	–	q_4
* q_4	–	–

DFA table :-

	0	1
→ q_0	q_0q_1	q_0q_3
q_0q_1	$q_0q_1q_2$	q_0q_3
q_0q_3	q_0q_1	$q_0q_3q_4$
* $q_0q_1q_2$	$q_0q_1q_2$	q_0q_3
* $q_0q_3q_4$	q_0q_1	$q_0q_3q_4$