① Design a FSM to check whether the given decimal no is divisble by 3

② Design a FSM to check if the second last symbol is 'a' over $\Sigma = \{a, b\}$

③ Design a FSM to check if it contains atleast one occurence of substring "bba" over $\Sigma = \{a, b\}$

④ If Design a FSM to check if it does not contain any occurence of three consecutive b's over $\Sigma = \{a, b\}$

⑤ Define the following

ⓐ alphabet
ⓑ String / Sentence word
ⓒ language

⑥ Explain the various operations on language.
ⓐ Union
ⓑ Concatenation
ⓒ Closure / Positive closure.

⑦ Define Regular Expressions with example.

⑧ Write R.E for the following-

ⓐ Set of all strings that start with 'a' over $\Sigma = \{a, b\}$

ⓑ Set of all strings that start and end with the same symbol over $\Sigma = \{0, 1, 2\}$

ⓒ Set of all strings that contain atleast two a's over $\Sigma = \{a, b\}$

⑥ Set of all strings that contain atmost two a's over Σ={a,b}

⑦ Set of all strings that start with xyyy & end with 'yyyx' over Σ={x,y}.

⑧ Explain F.A, components & working of F.A.

⑨ Explain difference between DFA & NFA.
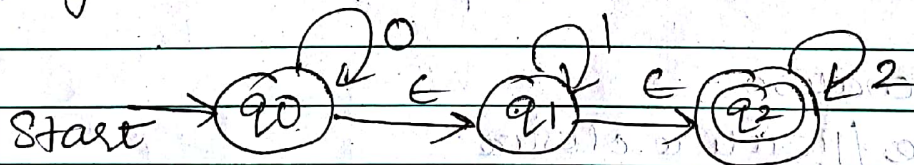
⑩ Draw NFA for given regular expressions.

ⓐ $x = 10 + (0+11)0^*1$
ⓑ $x = (a+b)^*ab$

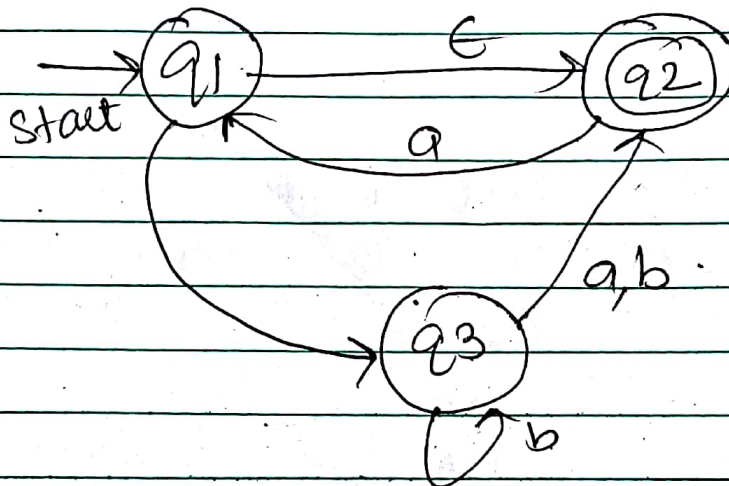⑪ Construct NFA from $x = (0+1)^*(00+11)$ and convert it to min DFA.

⑫ Construct a NFA without ε from the given NFA.

Start → q0 (0 loop) —a, ε→ q1 (1 loop) —ε→ q2 (2 loop)

⑬ NFA without ε to DFA.

δ	0	1
P	P,q	P
q	r	r
r	S	—
S	S	S̄

⑬ Convert the following NFA with ε to NFA without ε.

Start → q_1 —ϵ→ q_2

q_1 ←a— q_2

q_1 → q_3

q_3 —a,b→ q_2

q_3 —b→ (self loop)

(14) Write a the the steps to convert a transition diagram to regular expression.

(15) Find regular expression for the following.

Start → q_0 —b→ q_1

q_0 (self loop a)

q_0 ←a— q_1