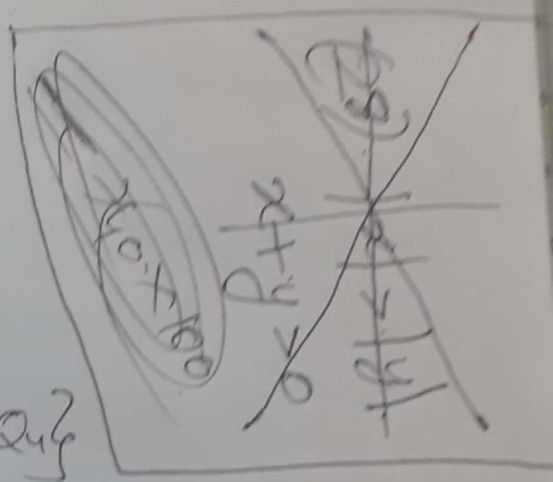
Problem 2 :-

Description :- The acceptable strings of the language are ε (Null string), aa, bb, aaaaabbbb, babbabb etc.
Non acceptable strings are aaaaaaaaba
bbbbbbbaba abababab etc
Deterministic finite automata for the given language is given above:



DFA M = $(Q, \Sigma, \delta, Q_0, F)$ where
Q = set of all states
$= \{q_0, q_1, q_2, q_3, q_4\}$
Σ = input Alphabet = {a, b}
Start state is q_0
F = Set of all states = $\{q_2, q_4\}$ and the transitions are defined in the transition diagram

Test cases:

Input 1 - aabb output :- string accepted
Input 2 - aaab output - string not accepted
Input 3 - aaaa output - string accepted
Input 4 - aaa output - string not accepted.