1. Given the description, what is the language of the machine/string accepted by the machine?
    a. The language of all strings consisting of n 0's followed by n 1's, for some n ≥ 0.
    b. The set of strings of 0's and 1's with an equal number of each.
    c. The set of binary numbers whose value is a prime
    d. L = { 0^n1 | n>=0 }
    e. L = { 0^n1^n| n >=1 }.

a. L = { ε, 01, 0011, 000111, 00001111 . . . . }

b. L = { 01, 10, 0011, 0110, 0101, 1100, 1001, 1010 ... }

c. L = { 01, 11 }

d. L = { 00, 01 }

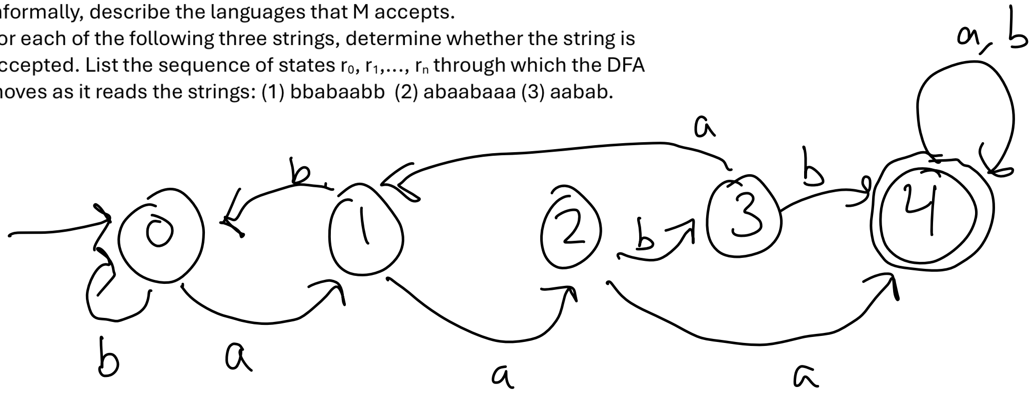
e. L = { 01 }

2. Given M = < {0, 1, 2, 3, 4}, {a, b}, δ, 0, {4}> where δ is given by the state transition table as below:

δ	*a*	*b*
0	1	0
1	2	0
2	4	3
3	1	4
4	4	4

a. Draw the state transition diagram for this DFA.
b. Informally, describe the languages that M accepts.
c. For each of the following three strings, determine whether the string is accepted. List the sequence of states $r_0, r_1, \ldots, r_n$ through which the DFA moves as it reads the strings: (1) bbababb (2) abaabaaa (3) aabab.

a.



b. M contains a subset "aaa" or "abb"

c. bbabaabb

$r_0 \xrightarrow{b} r_0 \xrightarrow{b} r_0 \xrightarrow{a} r_1 \xrightarrow{b} r_0 \xrightarrow{a} r_1 \xrightarrow{a} r_2 \xrightarrow{b} r_3 \xrightarrow{b} r_4$

Accepted

abaabaaa

$r_0 \xrightarrow{a} r_1 \xrightarrow{b} r_0 \xrightarrow{a} r_1 \xrightarrow{a} r_2 \xrightarrow{b} r_3 \xrightarrow{a} r_1 \xrightarrow{a} r_2 \xrightarrow{a} r_4$

Accepted

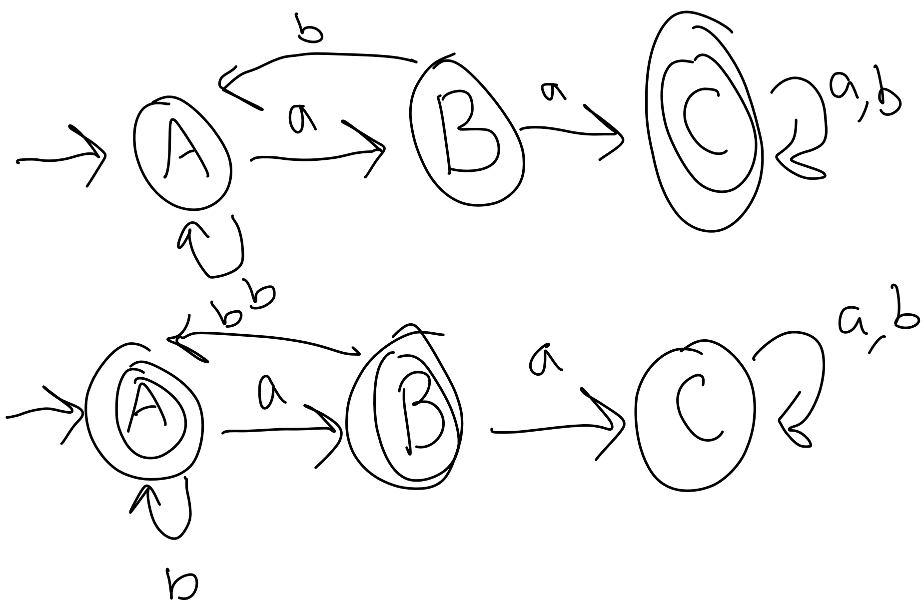
aabab

$r_0 \xrightarrow{a} r_1 \xrightarrow{a} r_2 \xrightarrow{b} r_3 \xrightarrow{a} r_1 \xrightarrow{b} r_0$

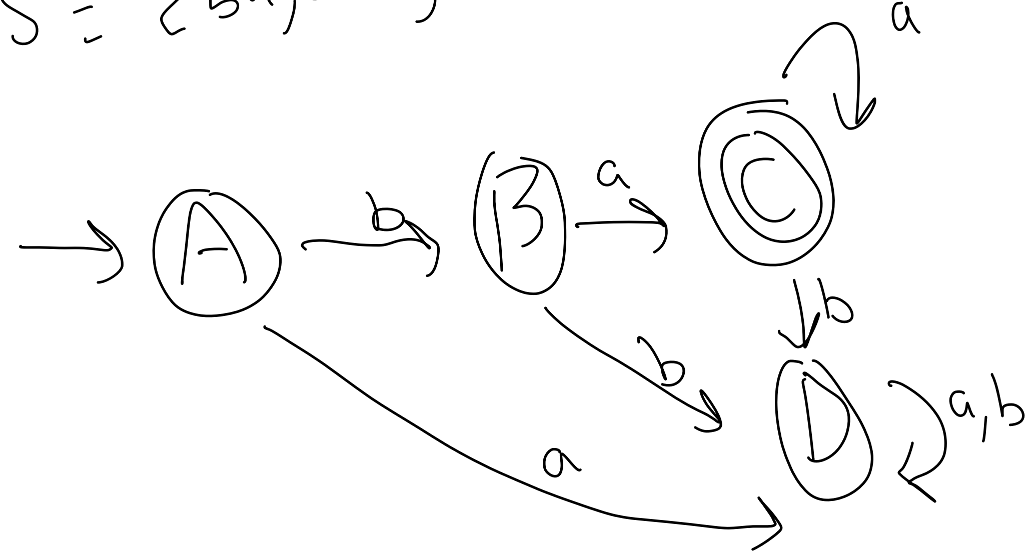
Rejected

3. Construct DFA for the given language defined by set S and $\Sigma = \{a, b\}$
   a. S = {string without substring aa}
   b. S = {ba, baa}
   c. S = {Starting and ending with a always}
   d. S = {accepts all strings not having more than two a's}

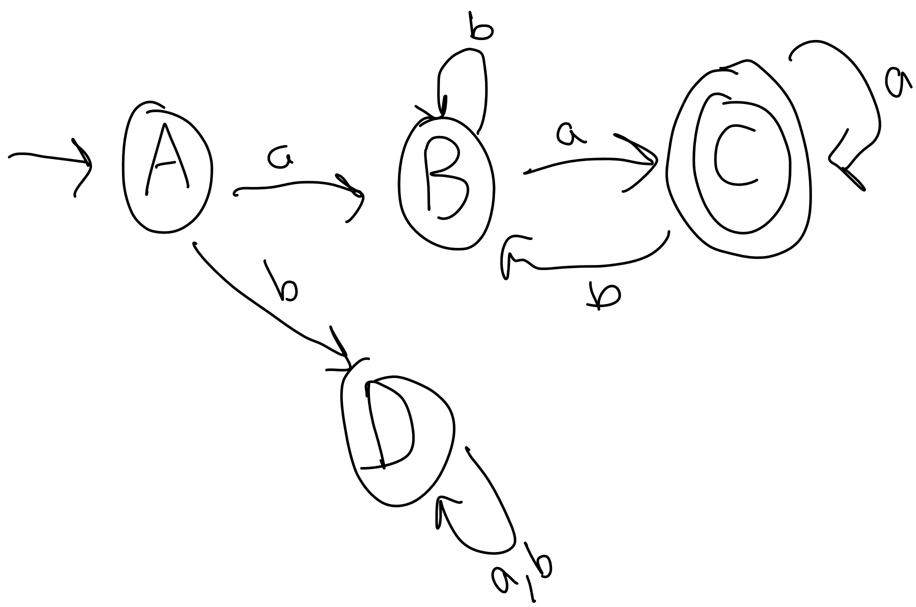
a.



b. $S = \{ba, baa\}$

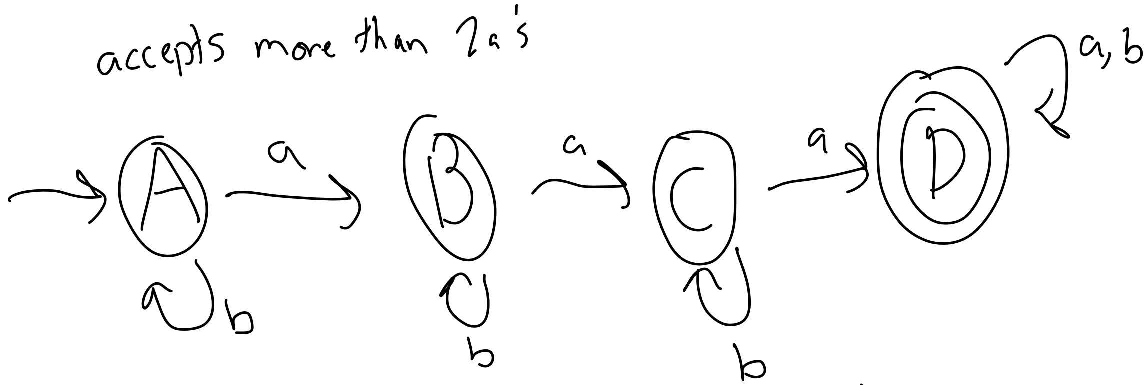


c. S = {starting & ending with a always}

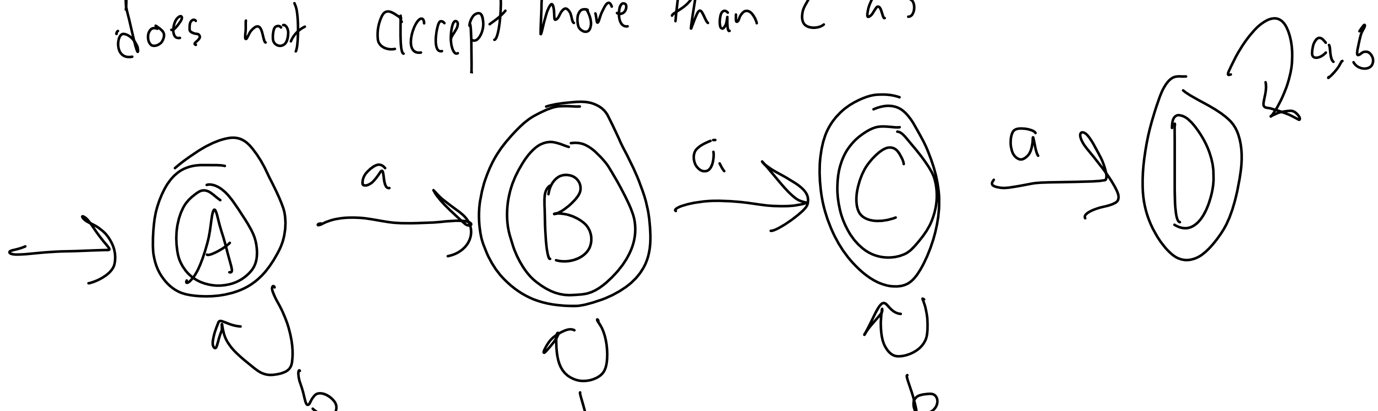


d. S = {accepts all strings not having more than 2 a's}

accepts more than 2 a's



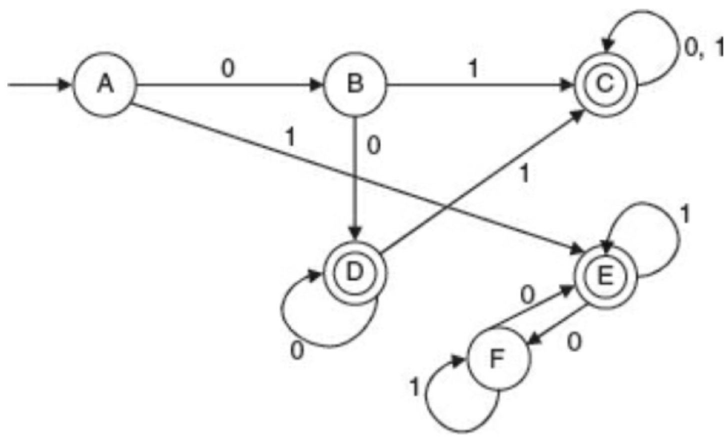
does not accept more than 2 a's



4. a. For the finite state machine M given in the following table, test whether the strings 101101, 11111 are accepted by M.

States	Input	
	0	1
*=>q0	q0	q1
q1	q3	q0
q2	q0	q3
q3	q1	q2

b. Give the formal description of the given FA.



a. 101101

$$q_0 \xrightarrow{1} q_1 \xrightarrow{0} q_3 \xrightarrow{1} q_2 \xrightarrow{1} q_3 \xrightarrow{0} q_1 \xrightarrow{1} q_0$$

Accepted

111111

$$q_0 \xrightarrow{1} q_1 \xrightarrow{1} q_0 \xrightarrow{1} q_1 \xrightarrow{1} q_0 \xrightarrow{1} q_1$$

Rejected

b. $Q = \{A, B, C, D, E, F\}$

$\Sigma = \{0, 1\}$

$\delta =$

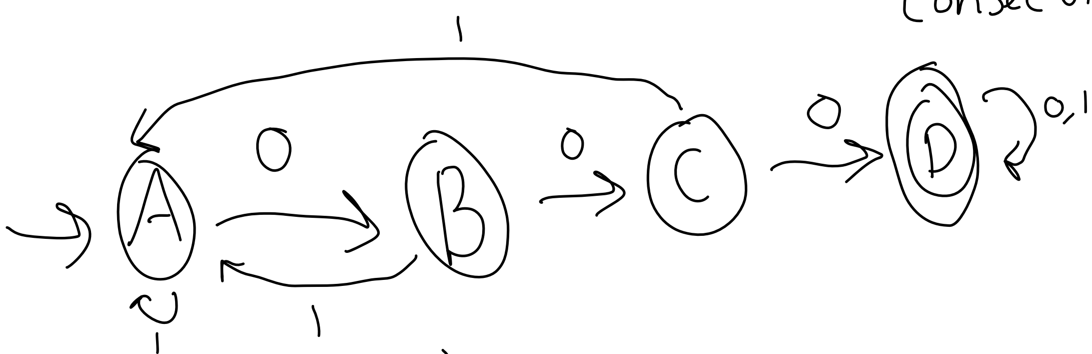
	0	1
A	B	E
B	D	C
C	C	C
D	D	C
E	F	E
F	E	F

$q_0 = A$

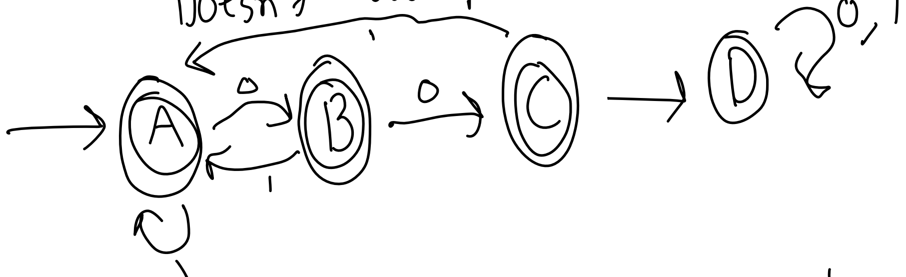
$F = \{C, D, E\}$

5. a. Design a DFA which doesn't accepts set of all strings containing three consecutive zero's.
   b. Design DFA which accepts all the strings not having more than two a's over $\Sigma = \{a, b\}$
   c. Give the DFA accepting the following language over alphabet {0,1} L = 'Set of all strings beginning with 1 that, when interpreted as a binary integer, is a multiple of 5.' For example, strings 101, 1010, and 1111 in the language; 0, 100; and 111 not.

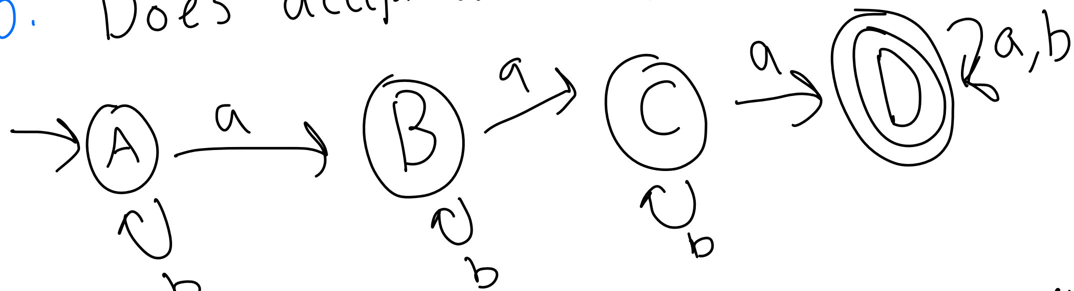
a. Does accept set of all string containing 3 consecutive 0's



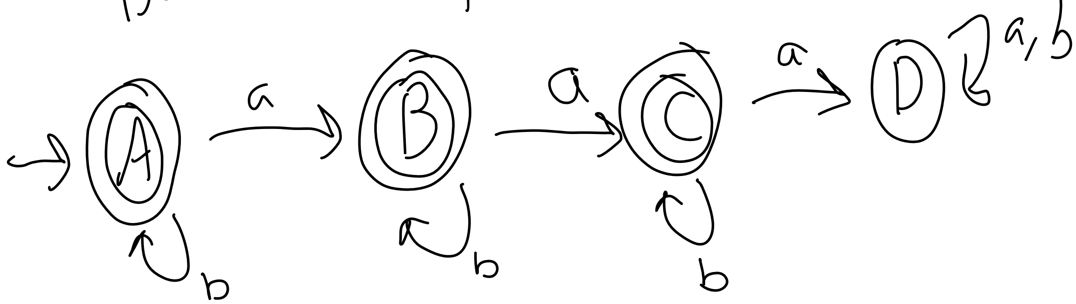
Doesn't accept



b. Does accept all strings having more than 2 a's



Doesn't accept all strings having more then 2a's



C.