CSE 331
Assignment 1
Summer 2025

Deadline : 10th November

Submit in google classroom. Don't forget to turn in.

1. Draw DFA's accepting the following languages over the alphabet {0,1}:
    a. Draw a DFA for the set of strings that have three consecutive 0s.
    b. Draw a DFA for the set of strings that doesn't contain 0s. ∑= {0,1}
    c. Draw a DFA of strings that ends with "0101".
    d. Construct a DFA defined as L = { w ∈ {0,1}*: w, when interpreted as a binary number, is divisible by 5.}
    e. The set of binary numbers has 0 in all even positions. Σ={0,1}.
    f. Draw a DFA which accepts exactly two "00" as a substring.
    g. Draw a DFA which accepts at most two "00" as a substring.
2. Draw DFA's accepting the following languages over the alphabet {0,1}:
    a. L_1 = {w ∈ a string where 1 is followed by at least one 0}, Σ = {0, 1}
    b. L_2 = {w ∈ a string which contains of odd length}, Σ = {0, 1}
    c. $L_3 = L_1 \cap L_2$
    d. L_4 = {w ∈ A string has substring of '010'}, Σ = {0, 1}
    e. Let Σ = {0, 1}. Consider the following languages over Σ.
        L1 = {w : every second letter of w is 0}
        L2 = {w : every third letter of w is 1}
        i. (a) Write down a length 5 string that is in L1 ∩ L2.
        ii. (b) Give the state diagram for a DFA that recognizes L1.
        iii. (c) Give the state diagram for a DFA that recognizes L2.
    f. (d) Give the state diagram for a DFA that recognizes L1 ∩ L2. (3 points)

3. Draw DFA's accepting the following languages over the alphabet {a,b}:

    a. Construct a DFA that accept the language, L = { w ∈ {a,b}*: w starts and ends with different symbols.}

    b. Construct a DFA that accept the language, L = { w ∈ {a,b}*: w starts and ends with the same symbol.}

    c. Construct a DFA defined as L = {w| each "b" is followed by at least one "a"} Σ = {a,b} For example: baaa

    d. Solve the following problems:
        i. Construct a DFA of the Language, L = { w ∈ {0,1}*: w = 0^m1^n where m and n are both odd.}
        ii. b) Construct a DFA of the Language, L = { w ∈ {0,1}*: w =0^m1^n where m and n are both even.}
        iii. Or, c) The problem can also be designed as:
            1. L1 = {w : w = 0^m, where m is even}
            2. L2 = {w : w = 1^n, where n is even}

        L = L1 . L2 ; Prove L is a regular language by giving a state diagram for DFA.

4. Write regular expressions for the following languages:

    a. The set of all strings of 0s and 1s such that every pair of adjacent 0s appears before any pair of adjacent 1s

    b. The set of all strings of 0s and 1s **not containing** 101 as a substring.

    c. {w| w has an even number of a's and each a is followed by at least one b}

    d. {w| w is any string that doesn't contain exactly two a's}

    e. Construct a Regular Expression that generates the language L = { w ∈ {0,1}*: w contains at least two 1s.}

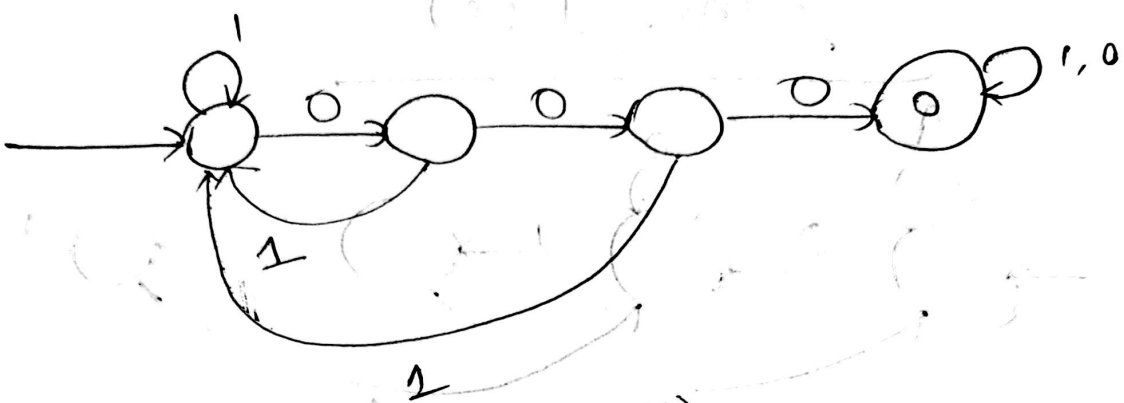
    f. {w| w starts with 0 and has odd length, or starts with 1 and has even length}

    g. Construct a Regular Expression that generates the language L = { w ∈ {0,1}*: w doesn't contain 00 and 11.}

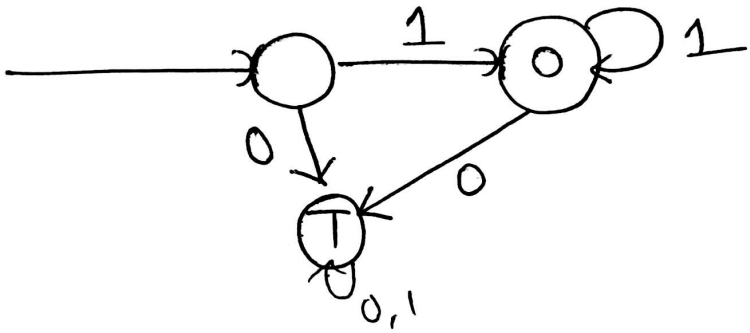
5. Convert the following regular expressions to NFAs with ε- transitions

    a. 01*
    b. 00 (0 + 1)*
    c. 0* (0 + 1) * 010 + 1*0 (10 +1)*

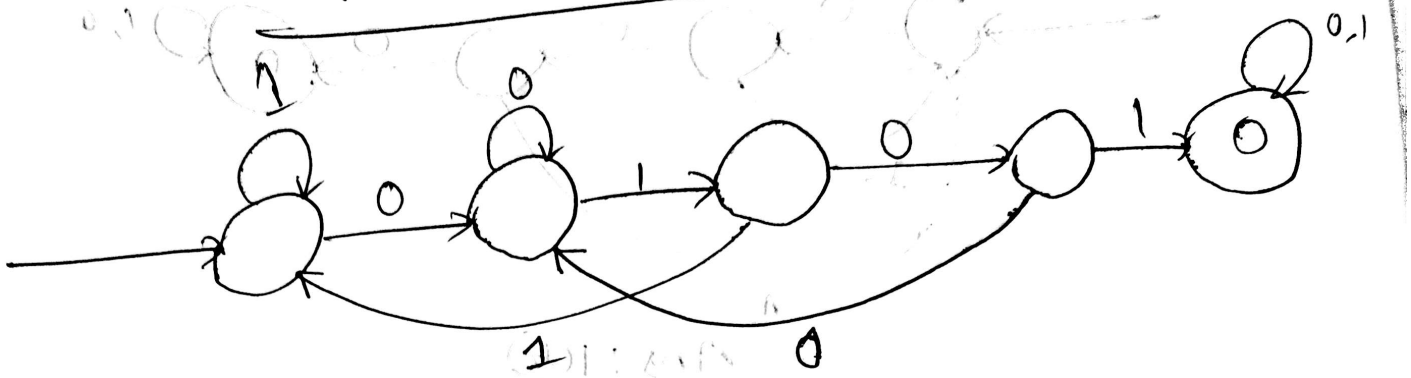
Ans: 1 (a)



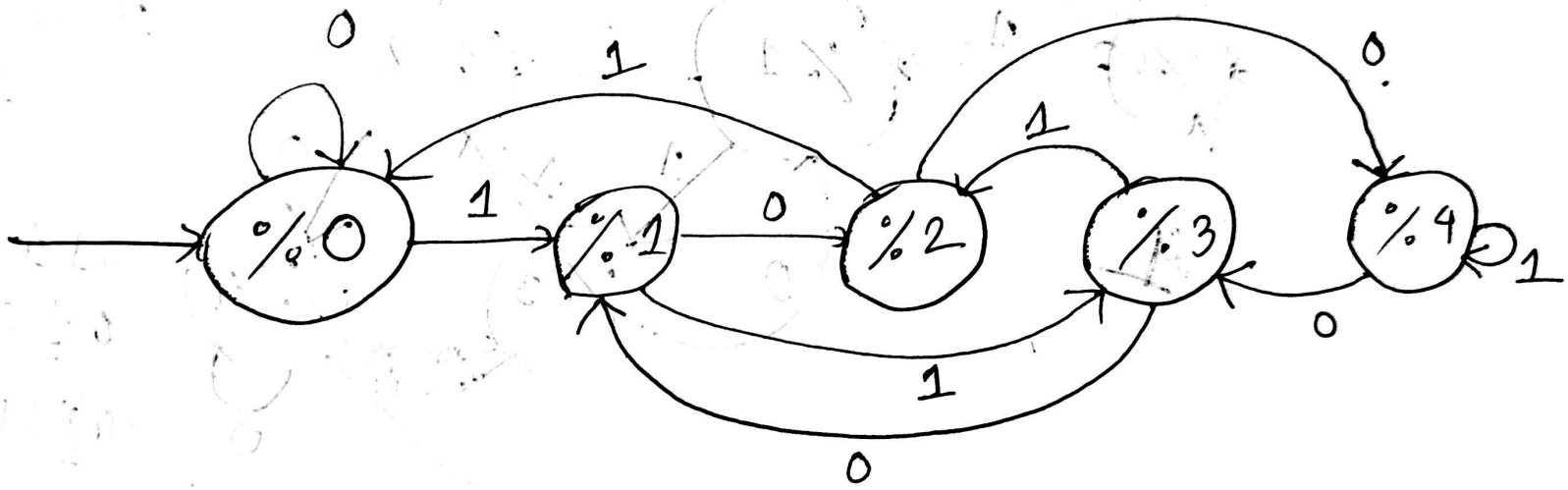
Ans: 1(b)



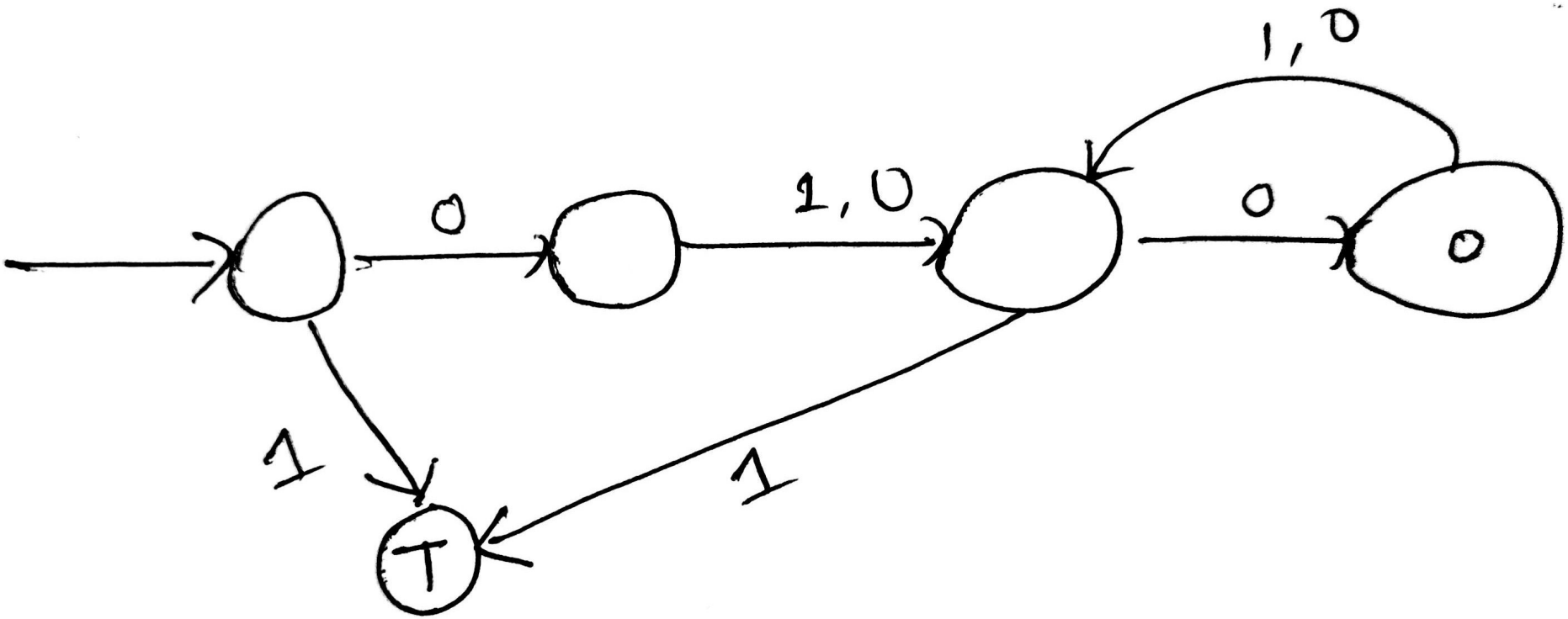
Ans: 1 (c)



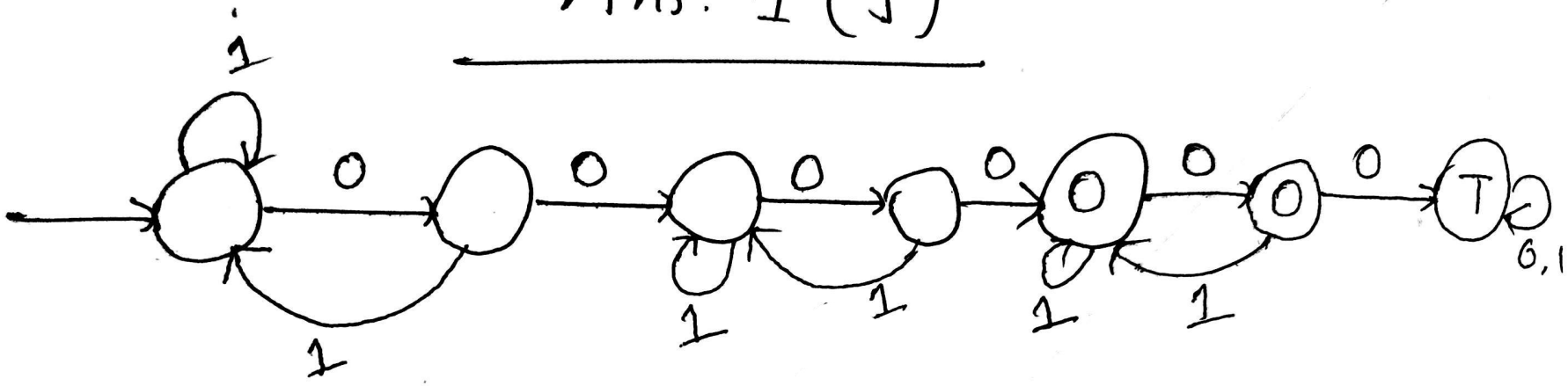
Ans: 1(d)



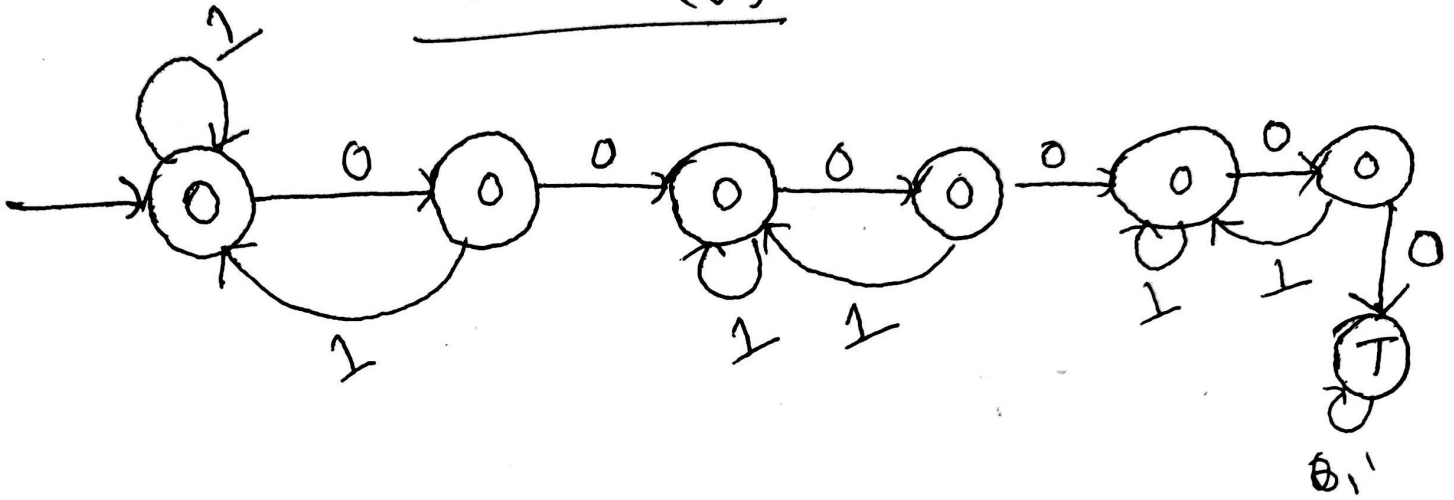
Ans: 1 (e)



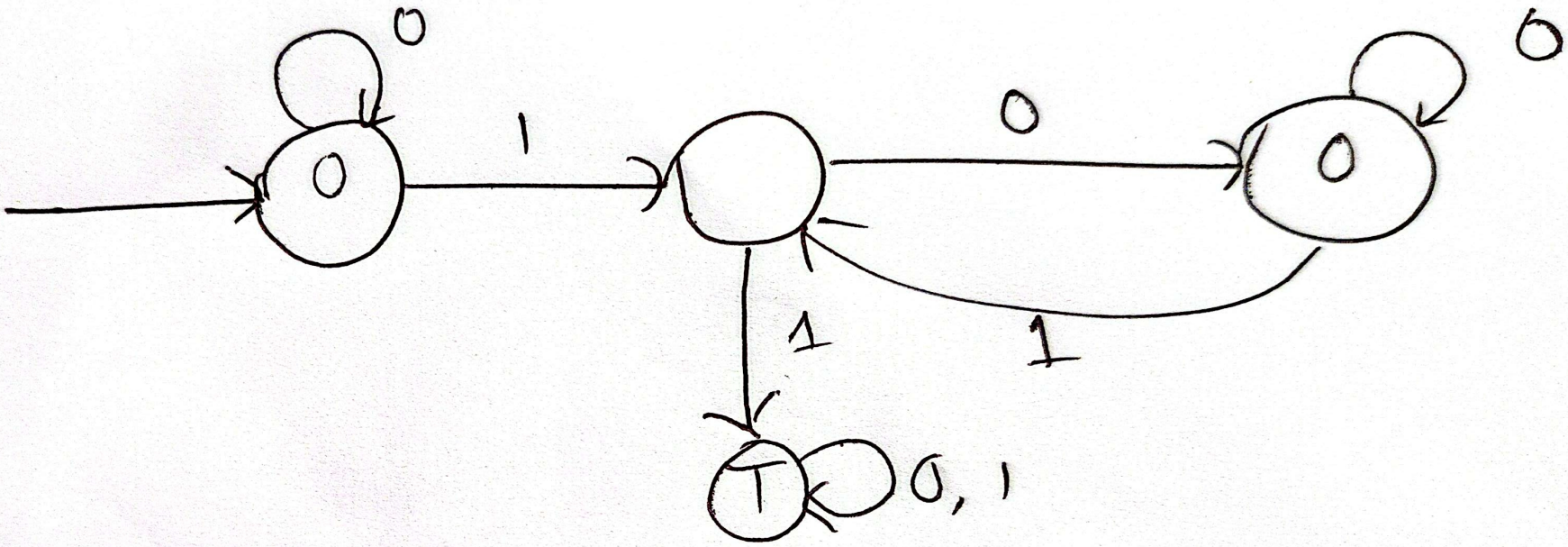
Ans: 1 (f)



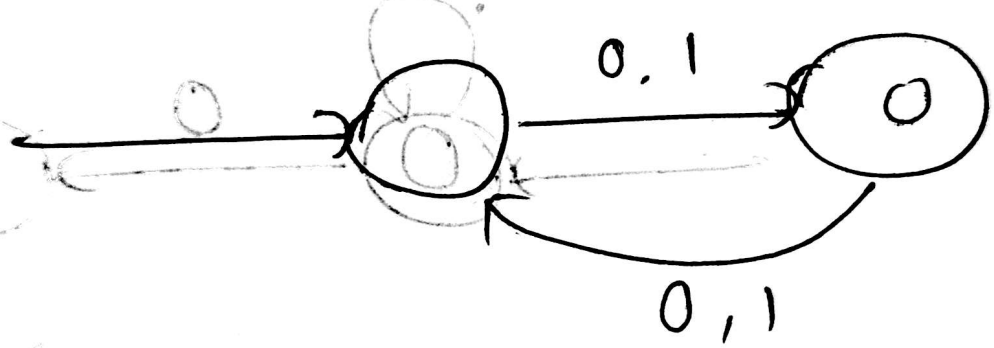
Ans: 1 (g)



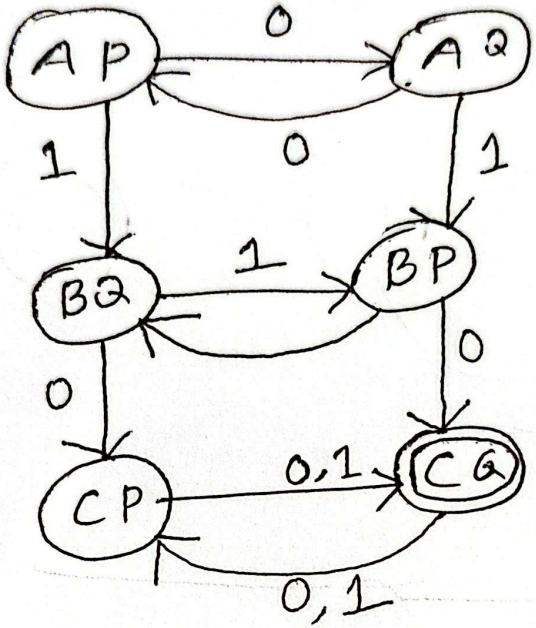
Ans: 2 (a)



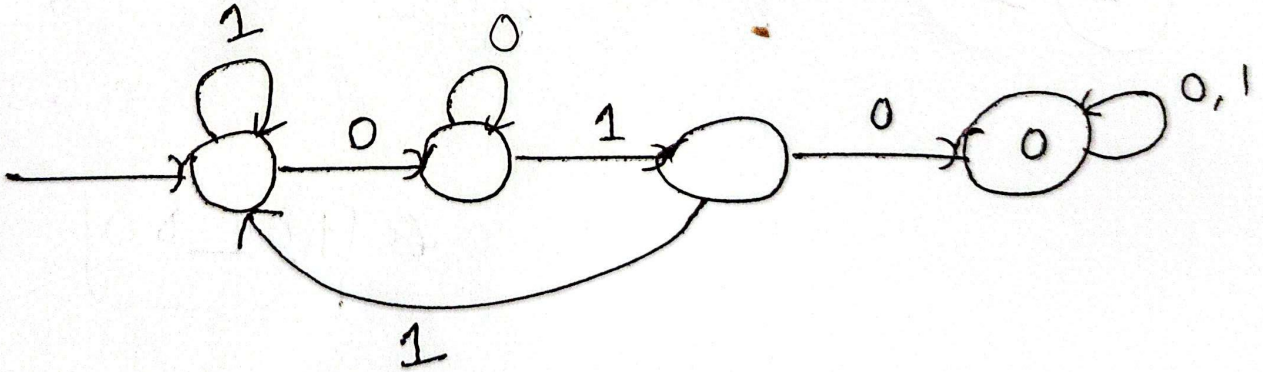
Ans: 2 (b)



c



d



Ans: 2

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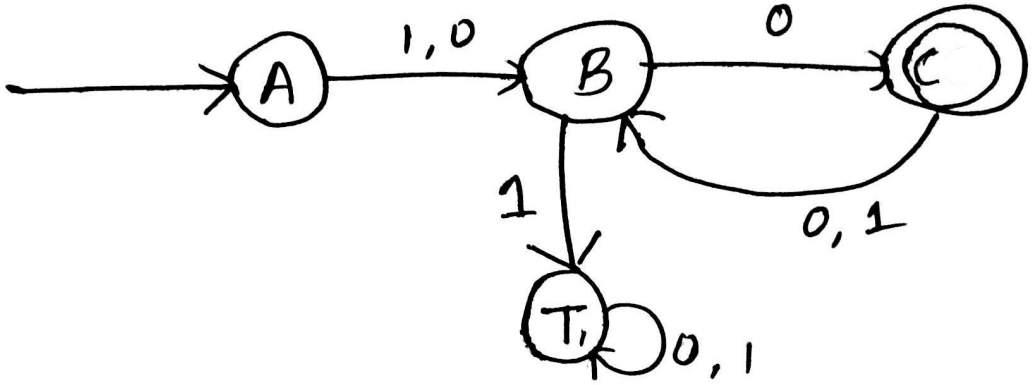
e i

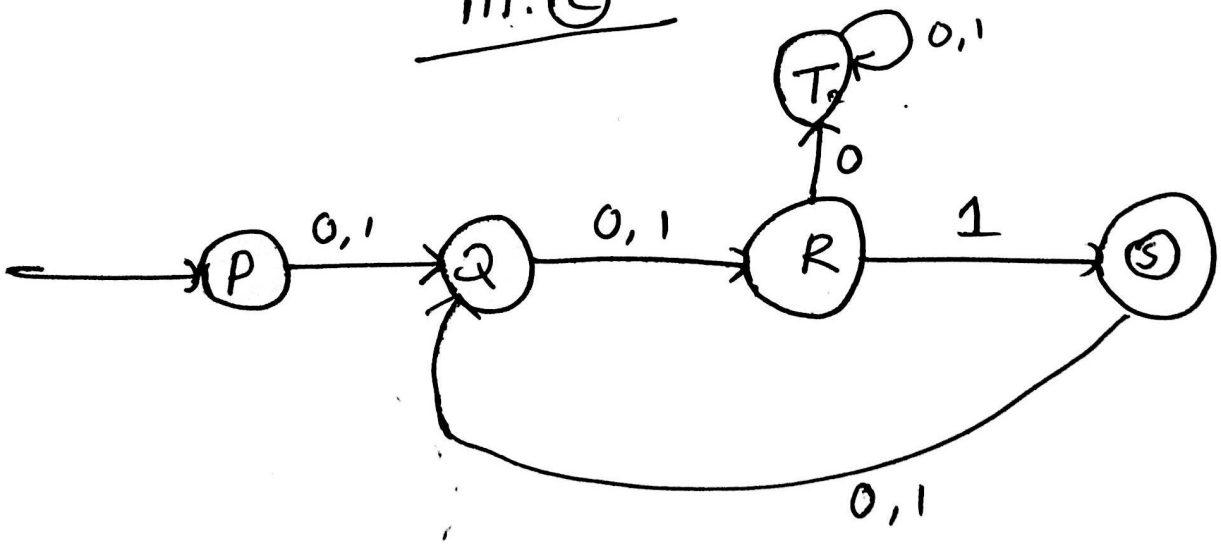
1

10101

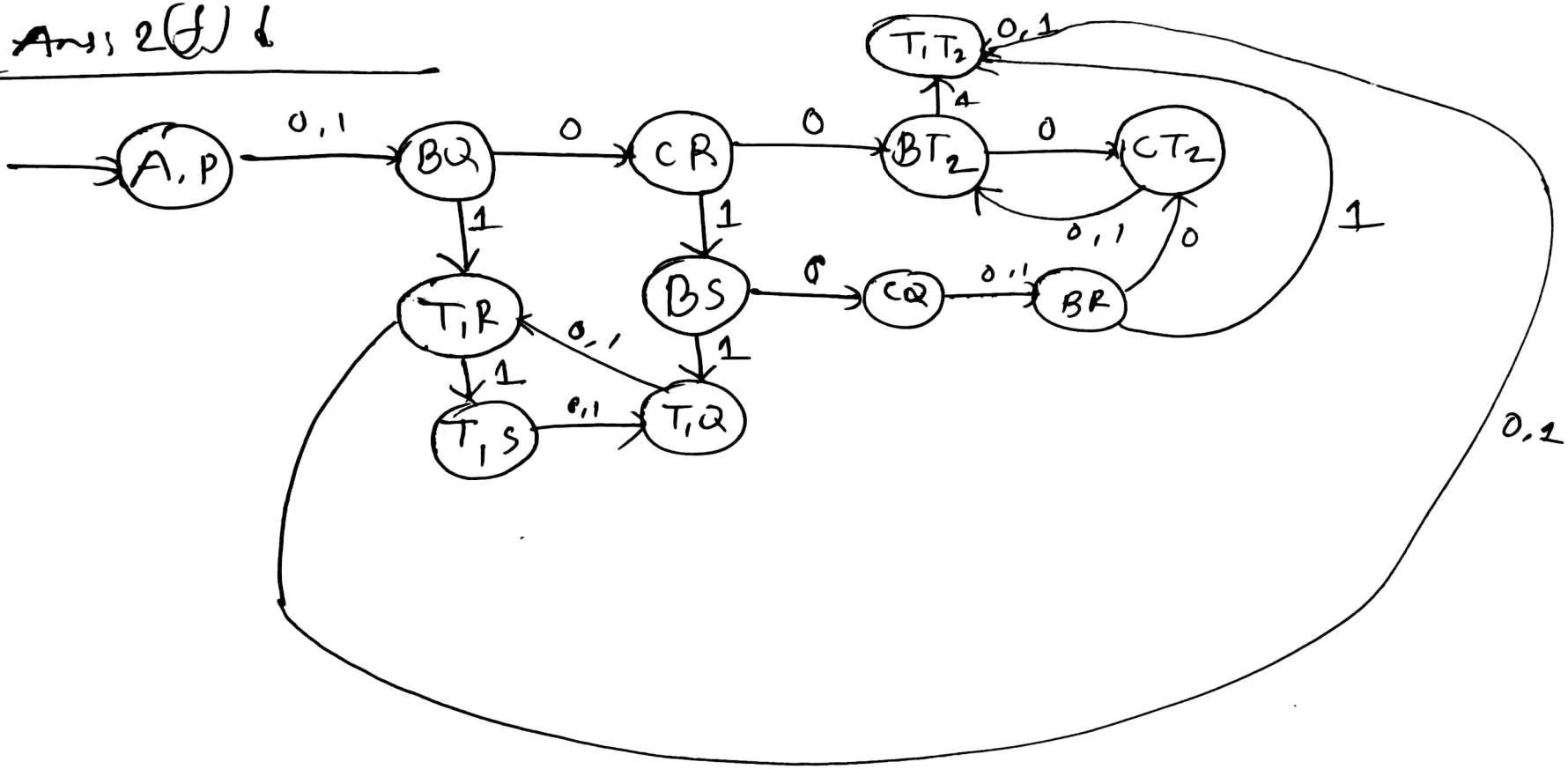
ii (b)



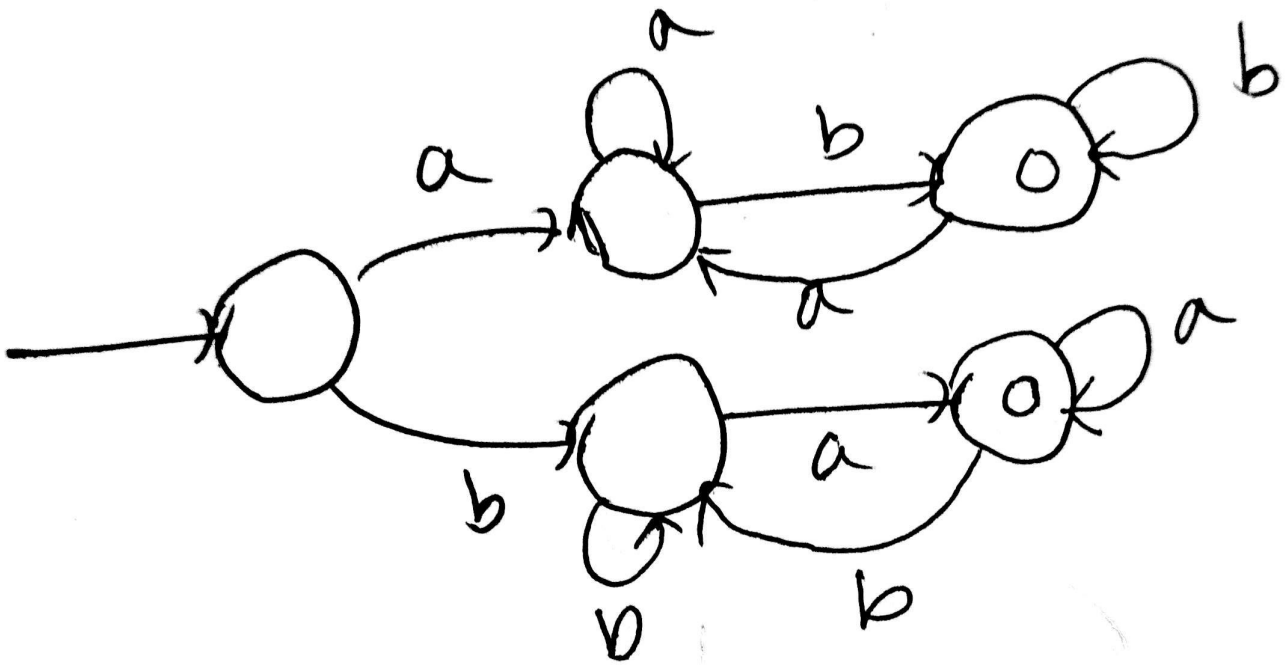
iii. (c)



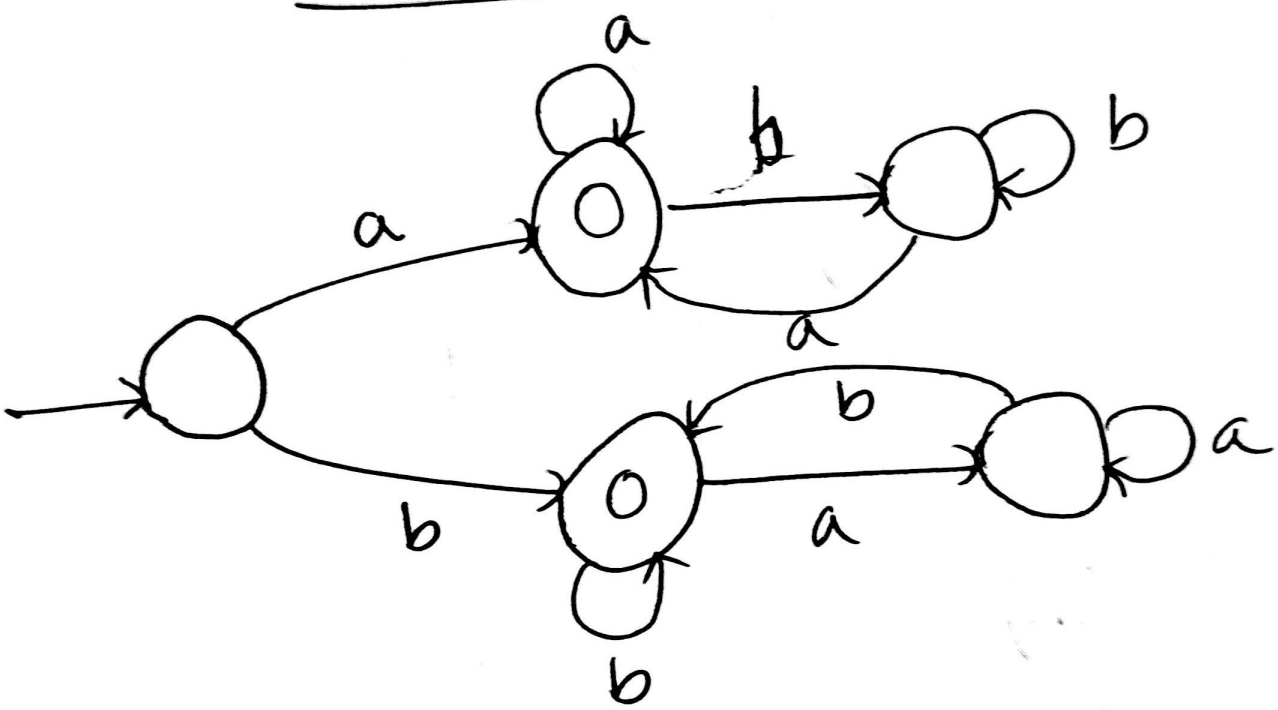
Ans: 2(f) i


A, P
0, 1
BQ
0
CR
0
BT2
0
CT2
0, 1
0
1
1
1
1
BS
0
CQ
0, 1
BR
T1R
0, 1
1
1
T1S
0, 1
T1Q
T1T2
0, 1
1
0, 1

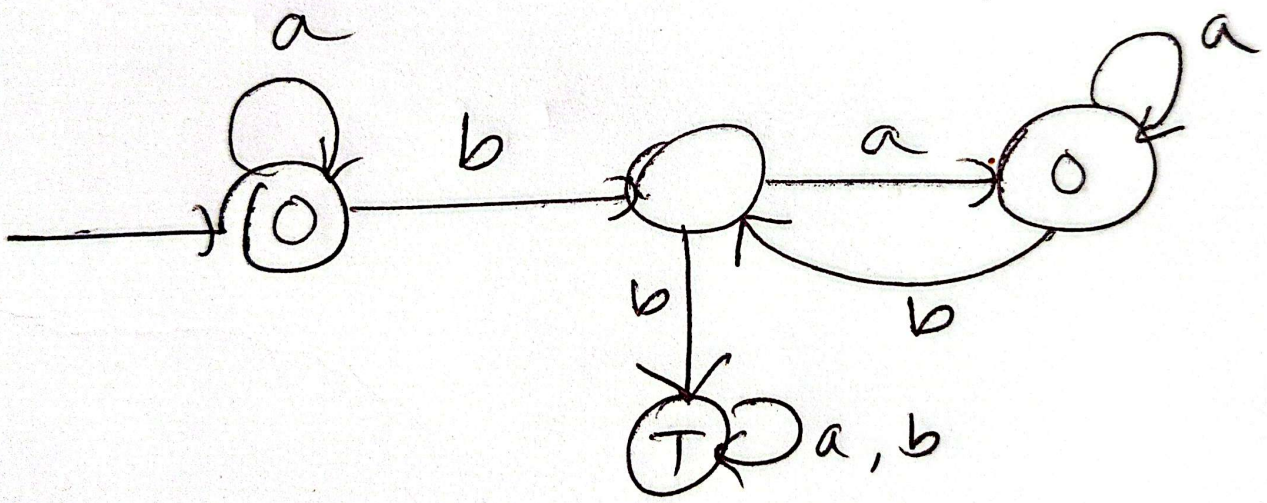
Ans: 3(a)



Ans: 3(b)

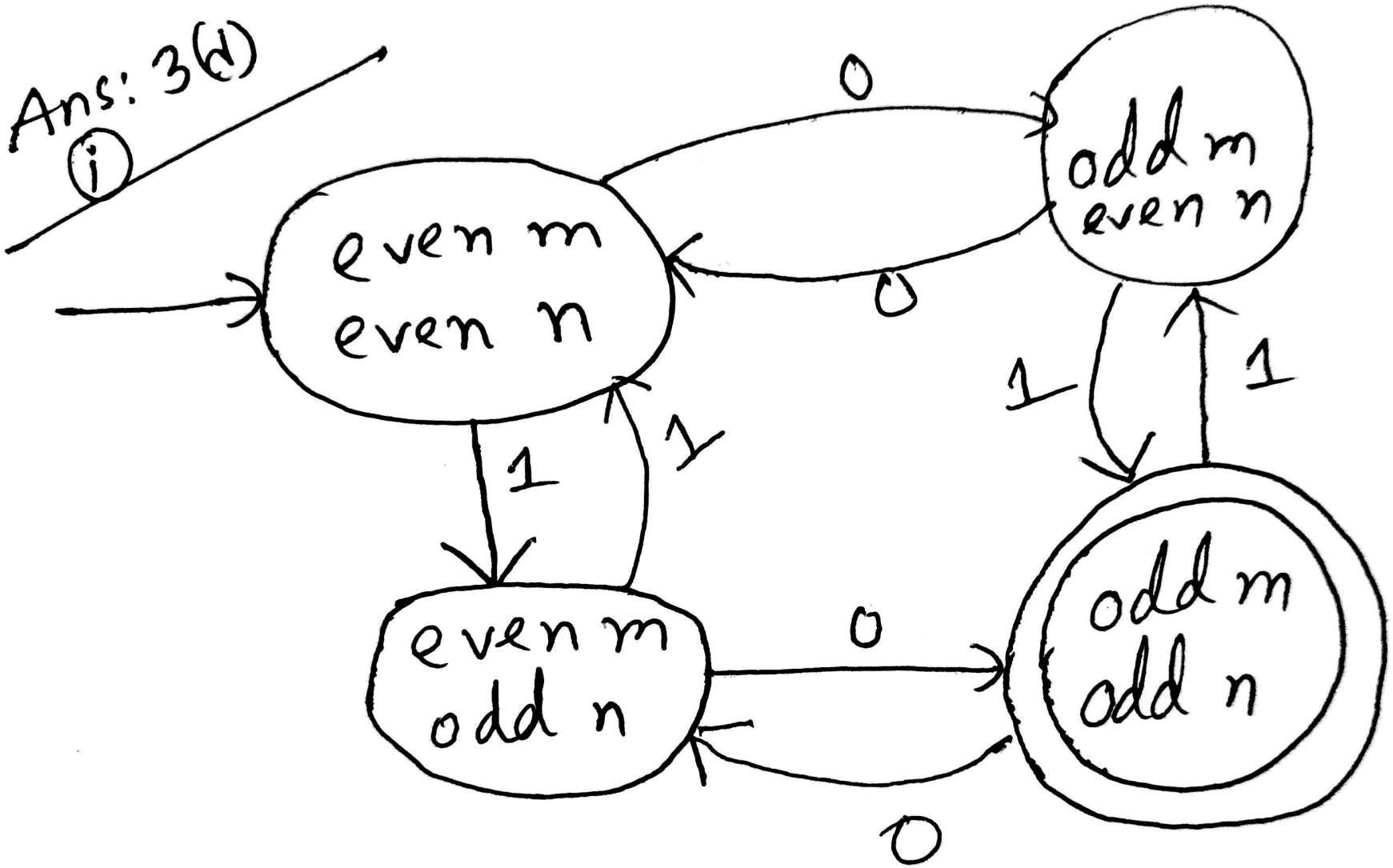


Ans: 3(c)

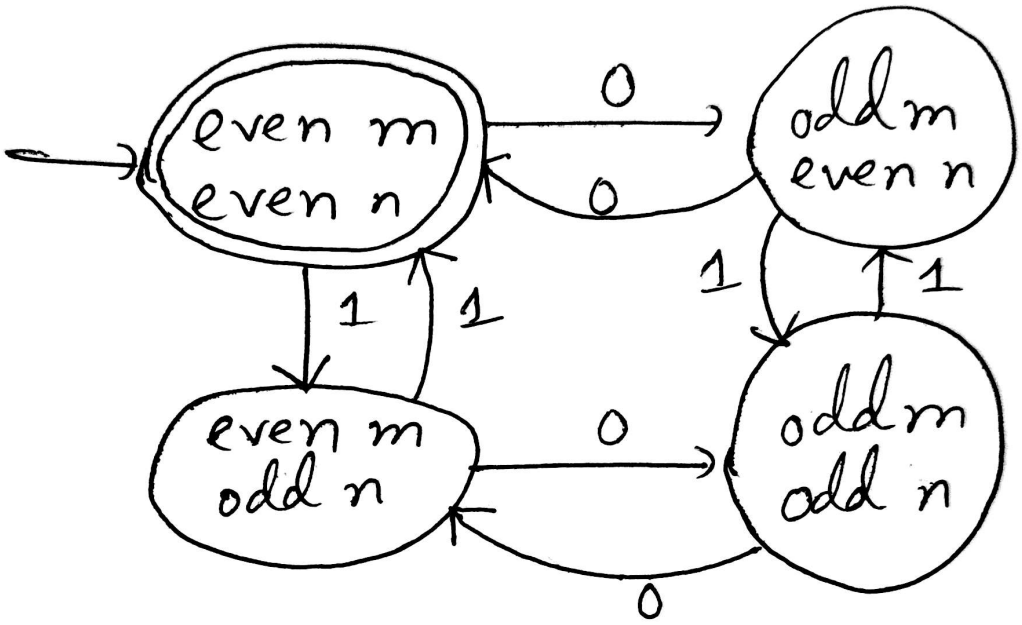


Ans: 3(d)

(i)



3.d(i)



Ans: 4(a)

$$(0+10)^*(1+\epsilon) + (0+10)^* 11 (1+10)^*$$

Ans: 4 (b)

$0^*(1^*000^*)^*1^*0^*$

Ans: 4(c)

$$(b^*ab^+ab^+)b^*$$

Ans: 4 (d)

$(1|01)^*(0|\epsilon)$

Ans: 4(e)

$$(0+1)^* 1 (0+1)^* 1 (0+1)^*$$

Ans: 4(f)

$$0(01)^* \mid 1^*(011)^*$$

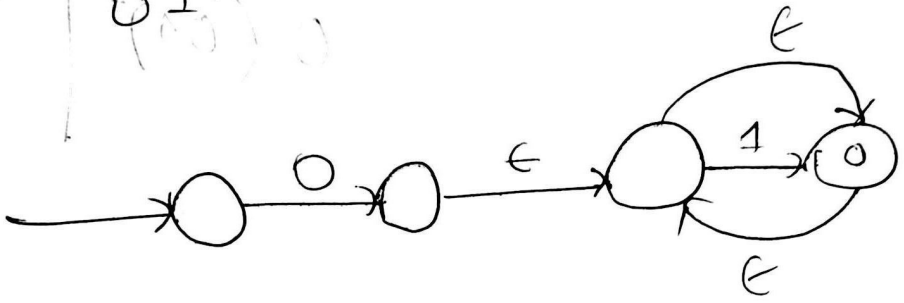
Ans. 4(g)

$0 + (02)^* + (10)^* + 1$

Ans: b

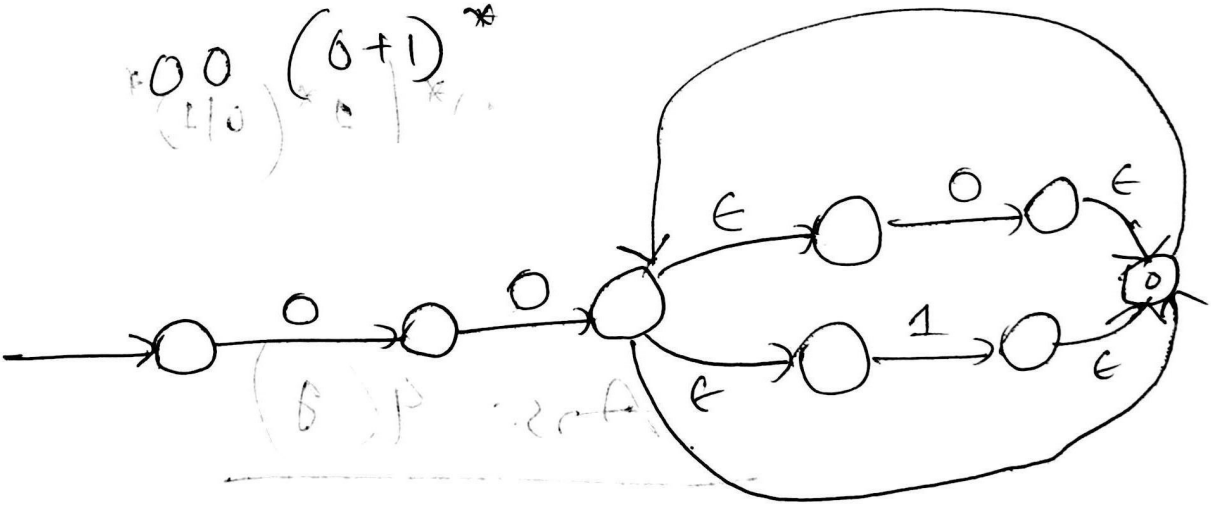
(a)

01^*



(b)

$00(0+1)^*$



(c)

$$0^*(0+1)^*010 + 1^+0(10+1)^*$$