1. [10 points] Find the regular expression for the given language.
   a. Write r.e. to denote a language L which accepts all the strings which begin or end with either 00 or 11.
   b. Write a r.e. to denote a language L over Σ^*, where Σ = {a,b} such that the 3rd character from right end of the string is always a.
   c. Construct r.e. which denotes a language L over the set $\Sigma = \{0\}$ having even length of string.

   d. Write r.e. which denotes a language L over the set Σ = {1} having odd length of strings.
   e. Construct regular expression for the language L over the set $\Sigma = \{a, b\}$ in which the total number of a's are divisible by 3.

a. $((00+11)\Sigma^*)+(\Sigma^*(00+11))$

b. $\Sigma^*(a\Sigma\Sigma)$

c. $(00)^*$

d. $(1)^+(11)^*$

e. $(\Sigma\Sigma\Sigma)^*$

2. [10 points] Describe language defined by following regular expressions,
   a. r = ((a+b) a)*
   b. r = (a + ∈) (b + ba)*
   c. r = (a* b*)*
   d. r = [a* b a* b a*]⁺
   e. r = b*(∈ + a + aa) b*

a. The string is either empty or ends in an a.

b. The string is empty or starts with a or ends in b or ends in ba.

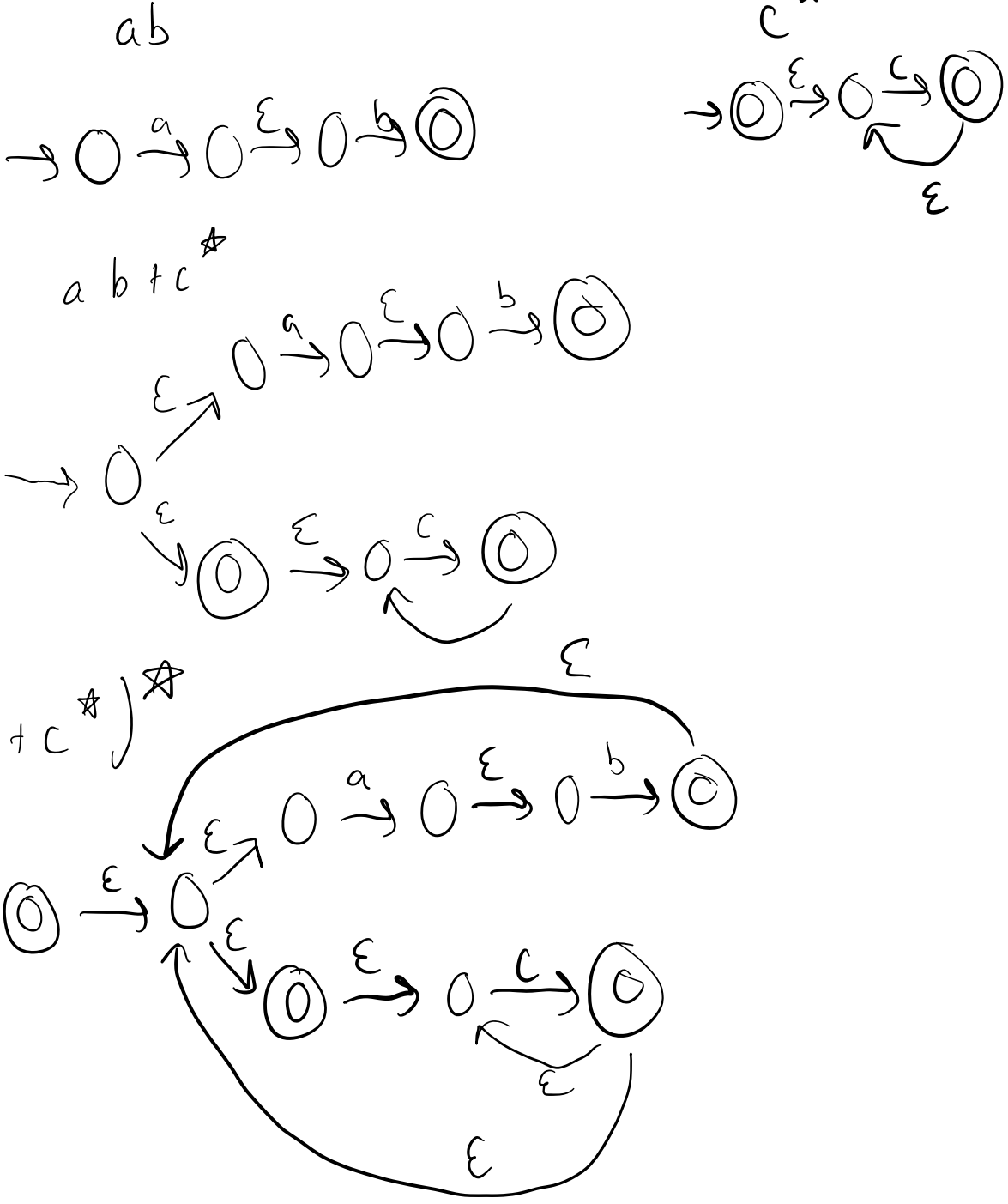
c. The string is 0 or more a followed by 0 or more b.

d. The string contains at least 2 bs.

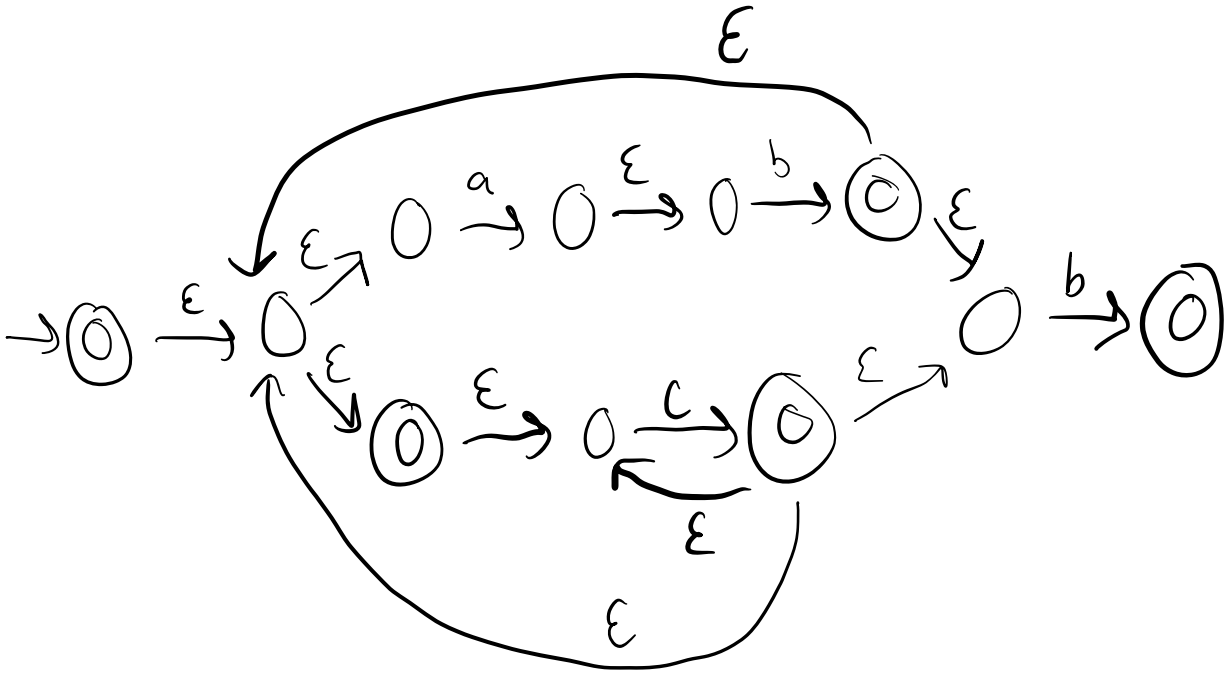
e. The string starts with 0 or more bs followed by 0, 1, or 2 as followed by 0 or more bs.

3. [30 points] Convert the given RE to FA
   a. (ab+c*)*b
   b. (1(00)* 1 + 01* 0)*
   c. 10 (0 11) 0 1*
   d. (0+1)*(010 + 101) (0+1)*
   e. 01[((10)* + 111)* + 0]* 1

a.

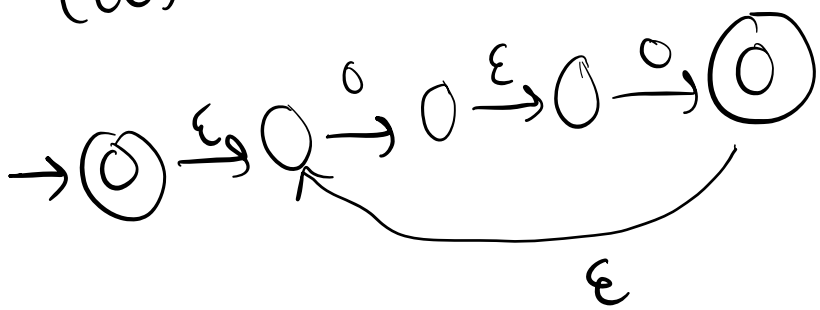


$(ab + c^*)^* b$

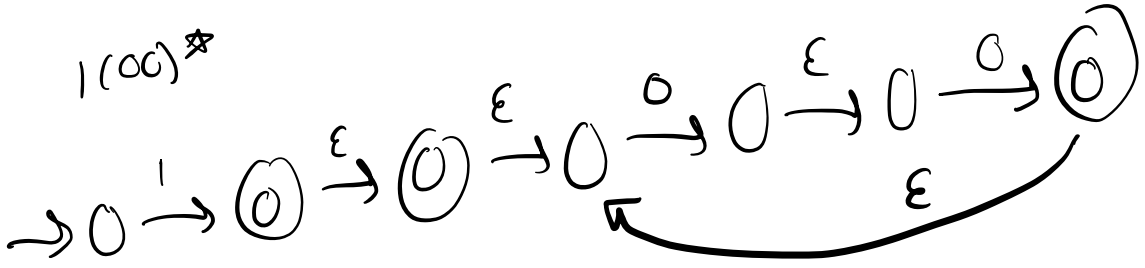


b. (1(00)* 1 + 01* 0)*

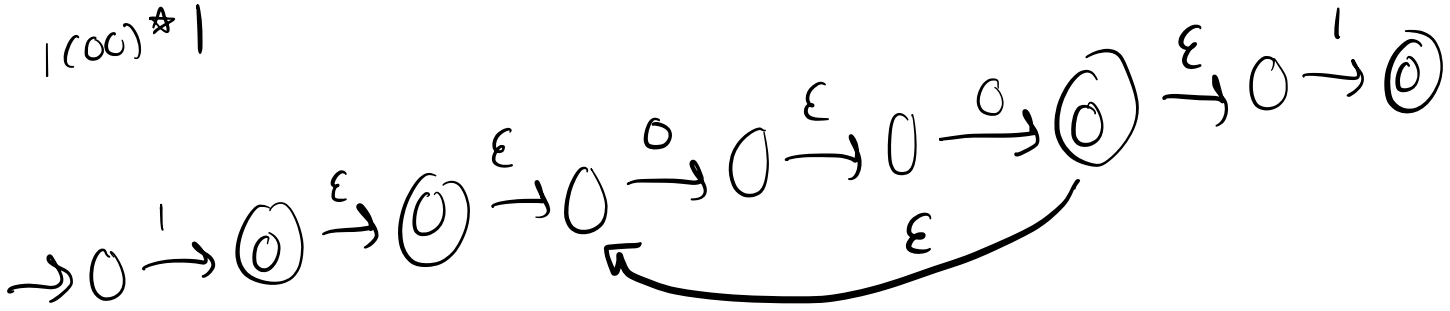
$(00)^*$



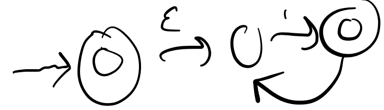
$1(00)^*$

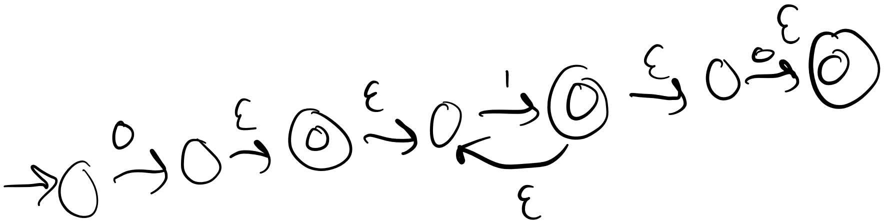


$1(00)^*1$

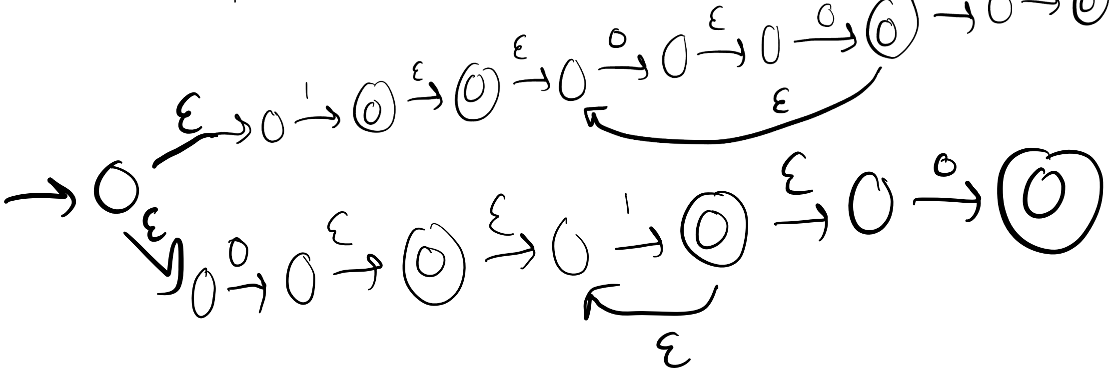


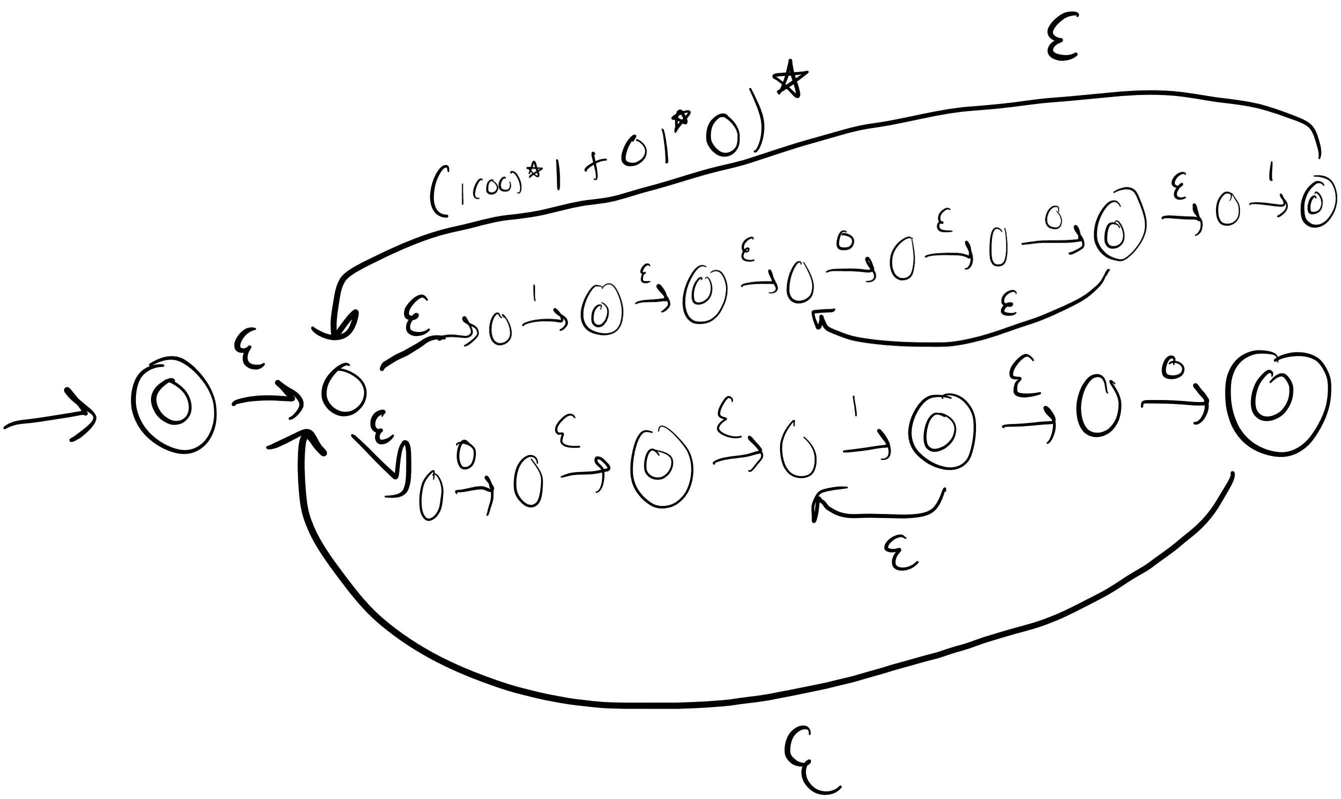
01^*0





$1(00)^*1 + 01^*0$





c. 10 (0 11) 0 1*

d. (0+1)*(010 + 101) (0+1)*

$(0+1)^*(010+101)(0+1)^*$