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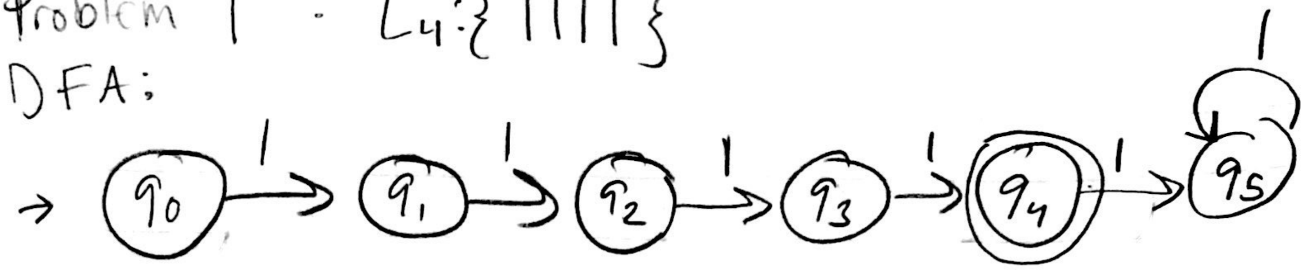
Problem 1 : $L_4 : \{1111\}$

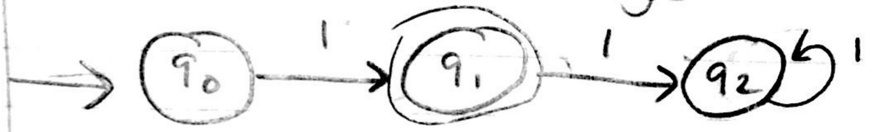
DFA:

a)



We cannot condense it to less states because the FSA would stop at the end state (q_4) and we need a state after it to show that if the length is more than 4, the end state is not achievable.

b) We can make an FSA with k=3 to prove this. Lets say $L_1 : \{1\}$. Our FSA has to have $k+2$ states so we would get



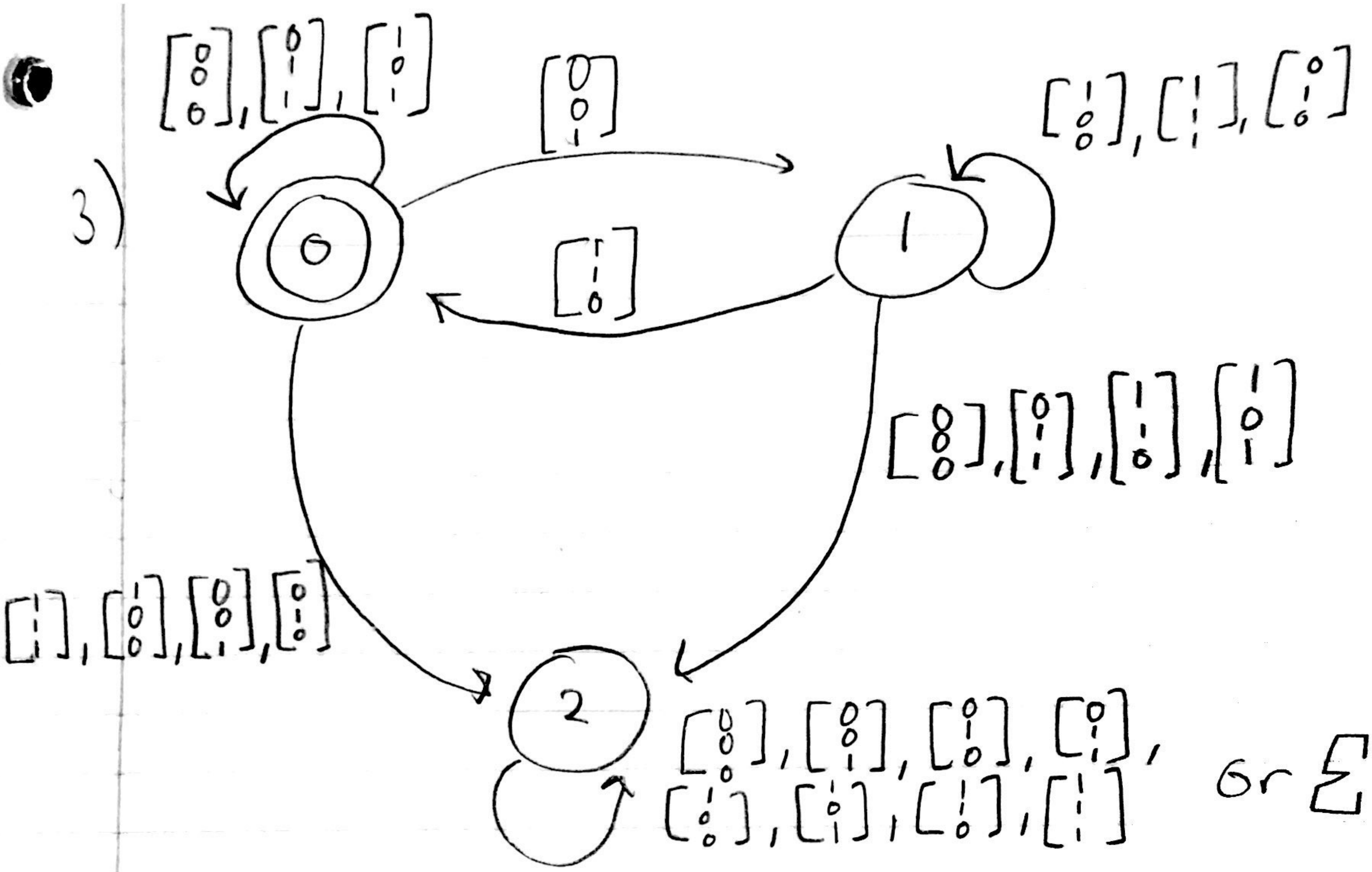
Because the FSA must have $k+2$, or $1+2=3$ states in this case, there is not a k-state FSA with less states that would recognize L_1. The FSA needs a third state to show that we cannot reach the end state if the input were to have a longer string length.

Problem 11

) For any language A, let $A^R = \{w^R \mid w \in A^R\}$, so if A is a ~~regu~~ regular language, A^R is a regular language as well.

Using our knowledge on how to reverse languages, we can be sure that our first step would be to switch all the transition functions towards the opposite state. Next, we add another state and ~~[illegible]~~ give it a transition labeled ε taking it to the accept state. We then turn the accept state into a regular state and since we know that the language is reversed, ~~[illegible]~~ the initial state becomes the new accept state, making the added state to become the new initial state. Therefore, since the temp state led to the accept state and with the language being revered, it can be recognized by a machine, making it a regular language.

3)



FSA recognizes B

If we use the method from (2), we get...