Problem 1 (CO1): DFA and Regular Languages (10 points)

Let $\Sigma = \{0, 1\}$. Consider the following languages over Σ.

$$L_1 = \{w : w = 0^m 1^n, \text{ where } m, n \geq 0\}$$

$$L_2 = \{w : 1 \text{ does not appear at any even position in } w\}$$

Now solve the following problems.

(a) **Give** the state diagram for a DFA that recognizes L_1. (3 points)

(b) **Give** the state diagram for a DFA that recognizes L_2. (3 points)

(c) If you were to use the "cross product" construction shown in class to obtain a DFA for the language $L_1 \cap L_2$, how many states would it have? (1 point)

(d) **Find** all five-letter strings in $L_1 \cap L_2$. (1 point)

(e) **Give** the state diagram for a DFA that recognizes $L_1 \cap L_2$ using only four states. (2 points)

(a)
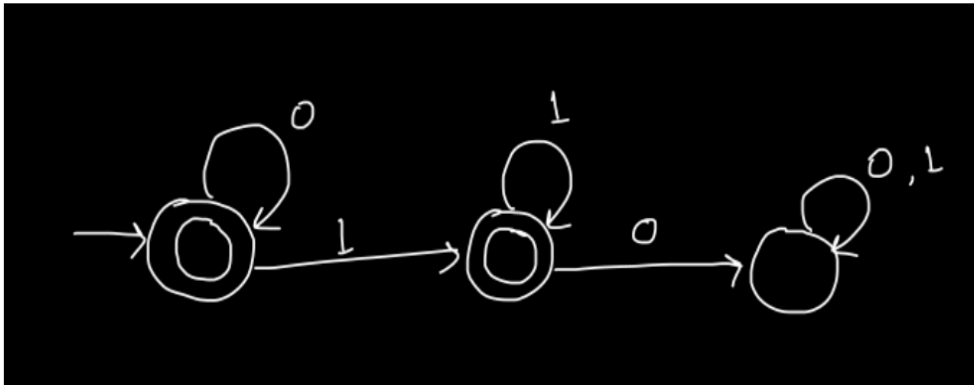
(b)
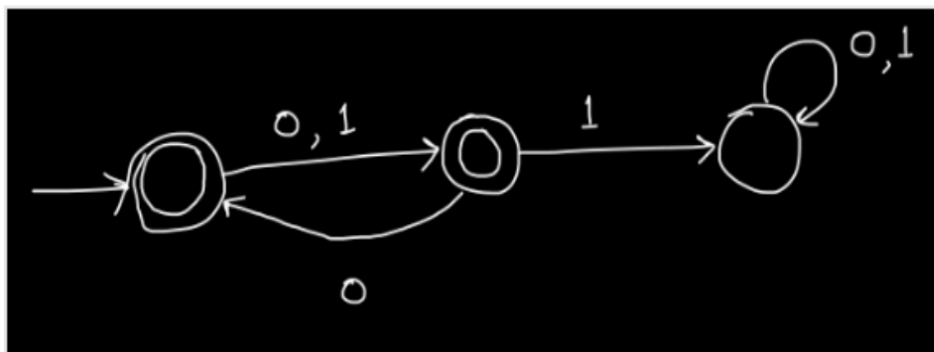
(c) The answer is 3*3=9.

(d) The strings are 00000 and 00001.

(e)