1. Description of the language recognized by the DFA:
The DFA recognizes an initial 0 or 1, then either two sequential characters of the opposite character as the initial character or one of the same, and finally any number of trailing 0's and 1's.

A regular expression that corresponds to this DFA is: **(011|00|100|11)([01]*)**

2. See Figure.

3. All strings in which ai occurs an even number of times for some i ∈ {1, 2, 3}.
*I interpret that this means we want all strings for which there is at least 1 character in {1,2,3} that occurs an even number of times.*
See Figure.

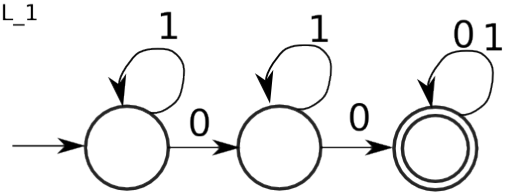
4. Write regular expressions for the following languages over the alphabet Σ = {0, 1}:
(a) All strings that contain at least one 0 and at least one 1 and that also end with at least two 1s.
**(1*)0([01]*)11** note the two 1s at the end satisfy the "at least one 1" requirement
(b) All strings that do not begin with 01.
**00([01]*)|0([01]*)**
(c) All strings that contain an odd number of 1s.
**(0*) 1 ( (0*)1(0*)1 )***

5. See Figure.

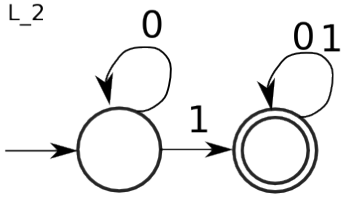
6.
aa(b*)
b+ (that is, at least one sequential b)
.

2

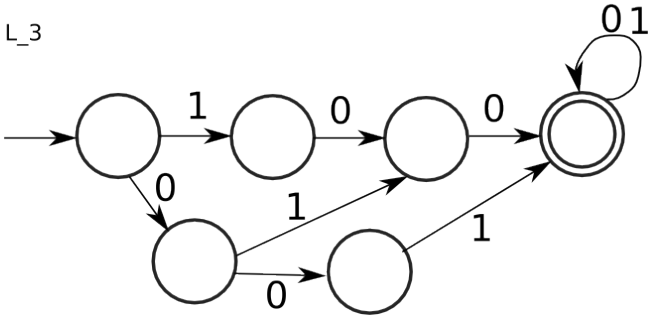
L_1



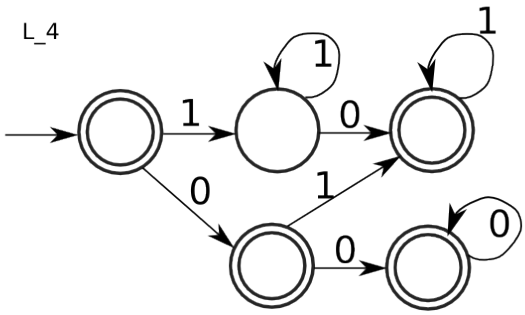

L_2



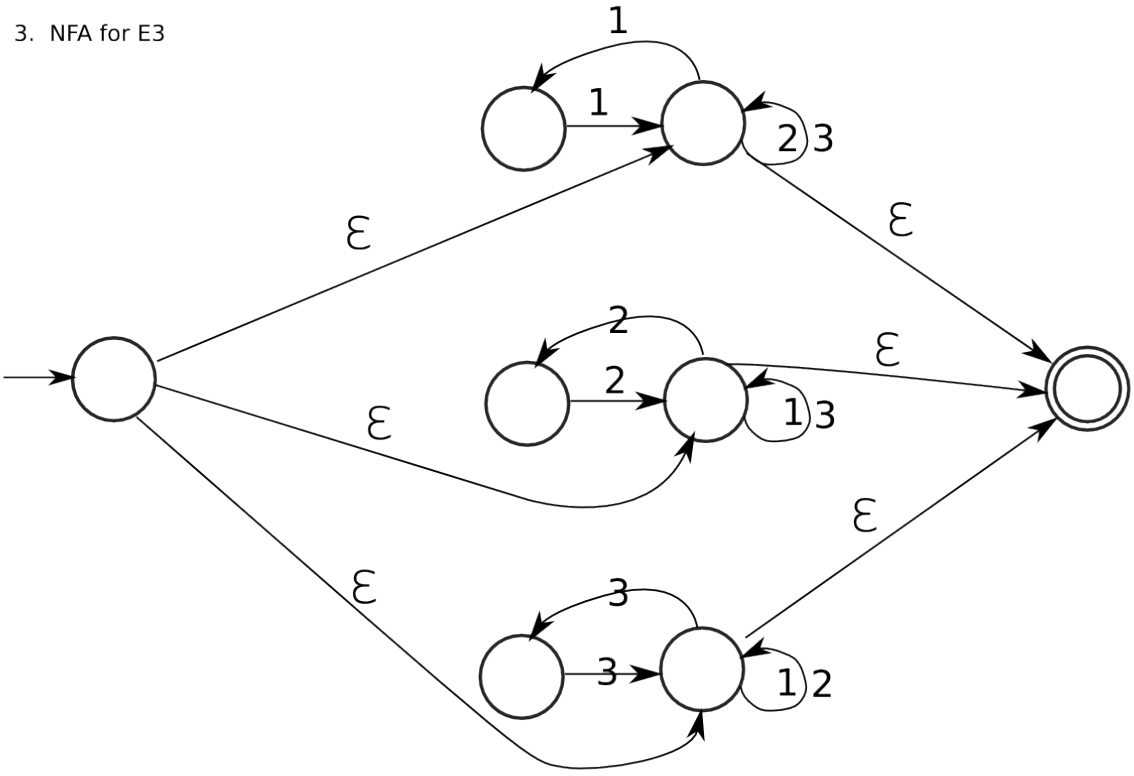

L_3



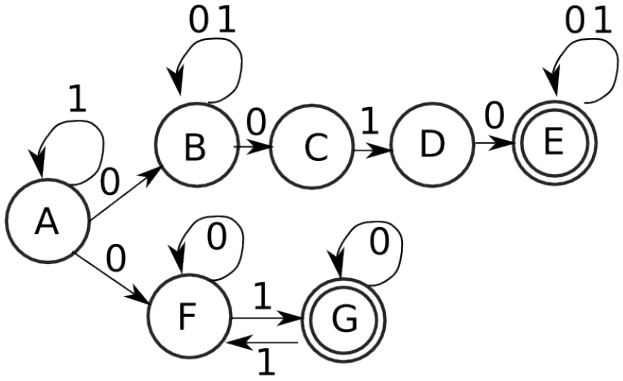

L_4



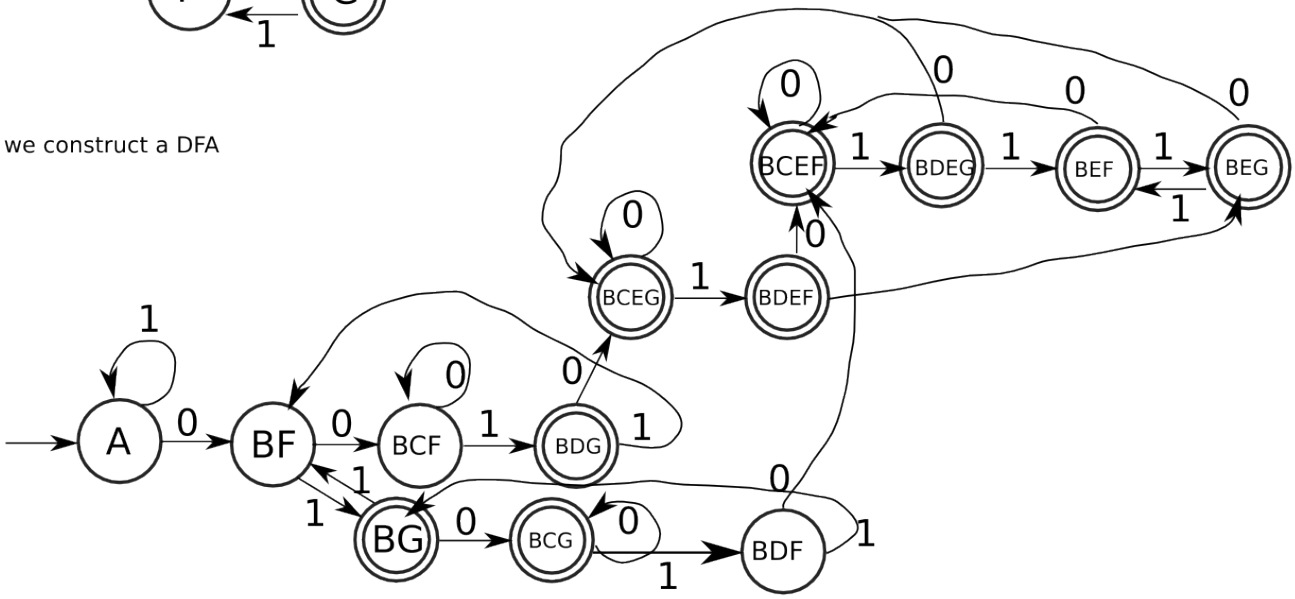

3. NFA for E3



5.a. After naming the states in the given NFA:




we construct a DFA




5.b. The language of the regular expression $(0 + 01)^* 1^*$