1) Let B_n = { a^k | where k is a multiple of n}.

I.e. B_1 = { a^k | where k is a multiple of 1} = { a^k | k ϵ {0,1,2,3,…}} = {‘’, a, aa, aaa, aaaa , …}

B_2 = { a^k | where k is a multiple of 2} = { a^k | k ϵ {0,2,4,6,…}} = {‘’, aa, aaaa, aaaaaa , …}

Show that for each n≥1, B_n is regular. **(20 pts)** Hints:

1) First prove that a^n is regular by induction on n. What is the induction variable. What is the formula as a function of the induction variable? What is the structure of the proof? What parts have induction hypotheses? You will need to appeal to the definition of what it means to be regular, and to closure properties of regular languages. State clearly what properties you use to justify each step.
2) Second, appeal to another closure property of the regular languages that uses the result of hint 1 to show that B_n is regular.

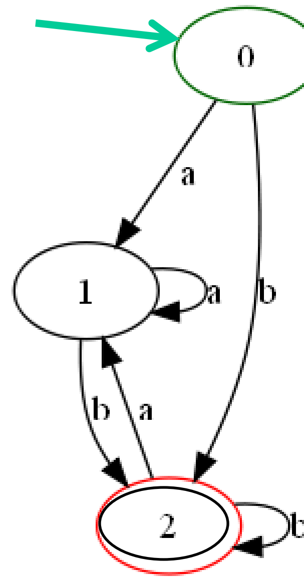
2) For each description, draw a state diagram of a DFA that recognizes the language.
In each case the alphabet $\Sigma = \{0,1\}$.

A. {w | Every odd position of w is a 1} **(6 pts)**

B. {w | w contains an even number of 0's, or is a string of length 2 with exactly two 1's} **(7 pts)**

C. {w | w doesn't contain the substring 110 } **(7 pts)**

3) Compute a regular expression that denotes the same set of strings as the DFA below. Use the state-ripping algorithm 1.5 Show the intermediate steps**. (20 points)**



4) Convert the following ε-NFA into a DFA. **(20pts) Hints**

1. First remove the **Λ** edge
2. Then use the subset construction
3. You may compute the subsets lazily