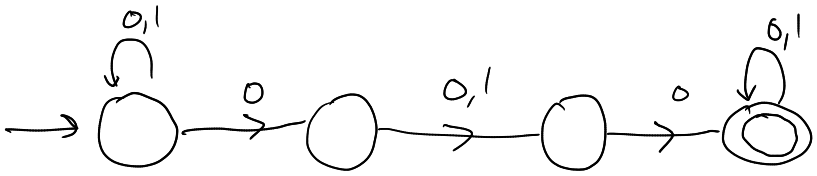
Name: Solutions

Directions: Show all work. No credit for answers without work.

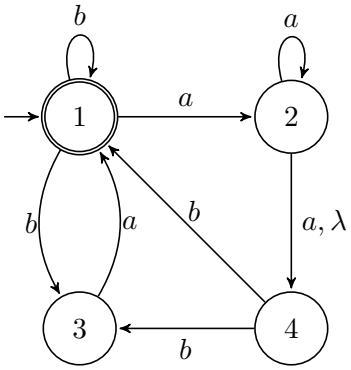
1. **[2 points]** Let $\Sigma = \{0, 1\}$ and

$$A = \{w \in \Sigma^* : w \text{ contains 000 or 010 as a substring}\}.$$

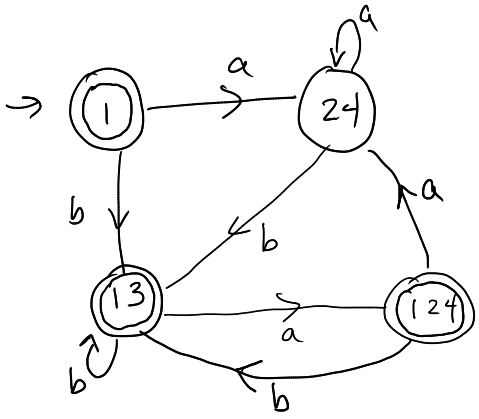
For example, $010 \in A$ but $0110 \notin A$. Construct an NFA for A with at most 4 states.



2. **[3 points]** Convert the following NFA to a DFA.

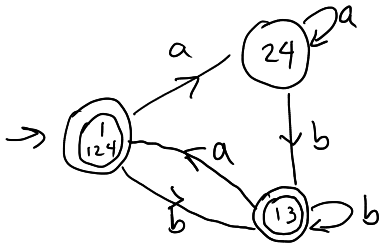


state	λ^*	$\lambda^* a$	$\lambda^* a \lambda^*$	$\lambda^* b$	$\lambda^* b \lambda^*$
1	1	2	24	13	13
2	24	24	24	13	13
3	3	1	1	$\emptyset$	$\emptyset$
4	4	$\emptyset$	$\emptyset$	13	13



Accept states: the sets containing 1

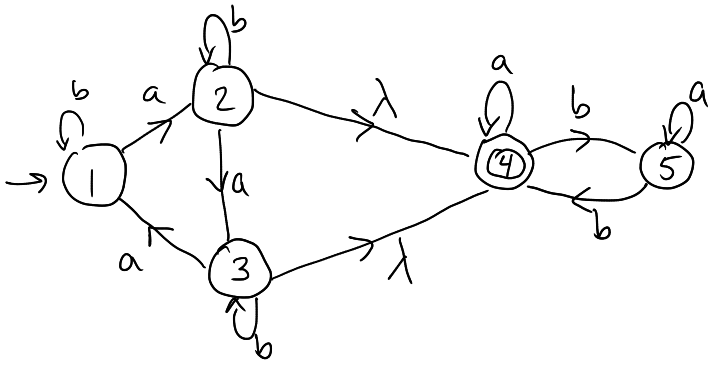
Note: Can simplify by combining states {1} and {1,2,4} to get:



3. Let $\Sigma = \{a, b\}$ and let

$$A = \{w \in \Sigma^* : \#a(w) \text{ is } \textit{not} \text{ a multiple of } 3\}$$
$$B = \{w \in \Sigma^* : \#b(w) \text{ is even}\}.$$

(a) **[3 points]** Give an NFA for the concatenation language AB.



	λ^*	$\lambda^* a$	$\lambda^* a \lambda^*$	$\lambda^* b$	$\lambda^* b \lambda^*$
1	1	2	24	1	1
2	24	34	34	25	245
3	34	14	14	35	345
4	4	4	4	5	5
5	5	5	5	4	4

(b) **[2 points]** Give a DFA for AB. Simplify your machine.