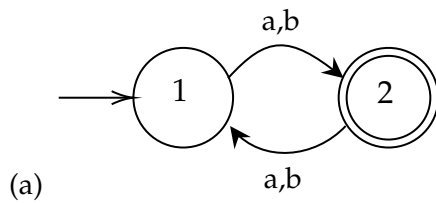


Name: Kevin Zhang

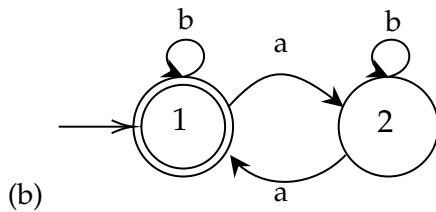
Problem 1.

Problem will be submitted through tint homework submission. Placeholder for correct problem numbering.

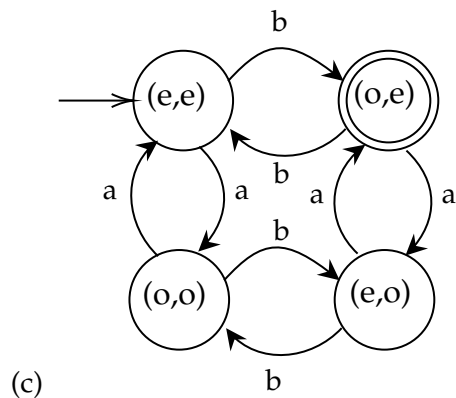
Problem 2.



where 1 is the state of even length, and 2 is the state of odd length.

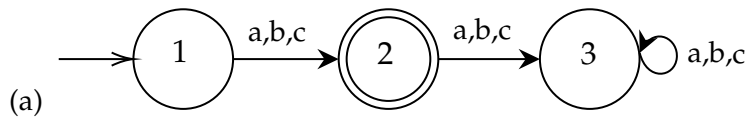


where 1 is the state of even number of a 's, and 2 is the state of odd number of a 's.

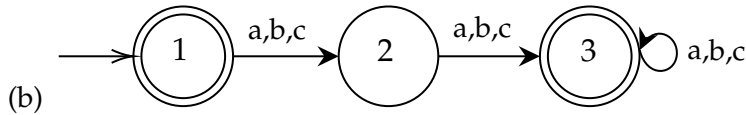


where each state is an ordered pair (q_1, q_2) such that $q_1 \in \{e, o\}$ and $q_2 \in \{e, o\}$. q_1 represents the length of the string (whether even or odd), and q_2 represents the number of a 's, whether even or odd.

Problem 3.



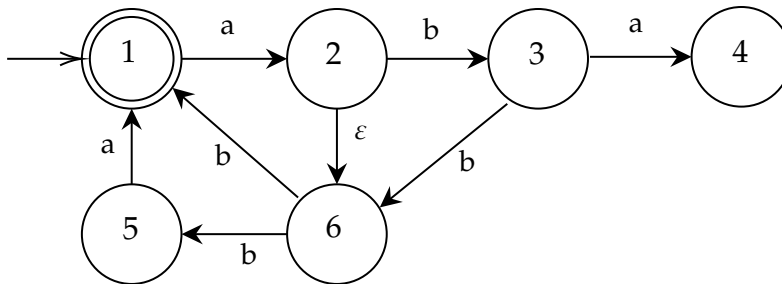
where 1 is the initial state, and 2 is a state where it's a single letter a , b , or c , and 3 is a rejected state where we've exceeded the one-letter limit.



where 1 is the initial state, and 2 is a state where it is a single letter a , b , or c . 3 is an accepting state where our word is not simply a single letter.

Problem 4.

Diagram and numbered for explanations down below.

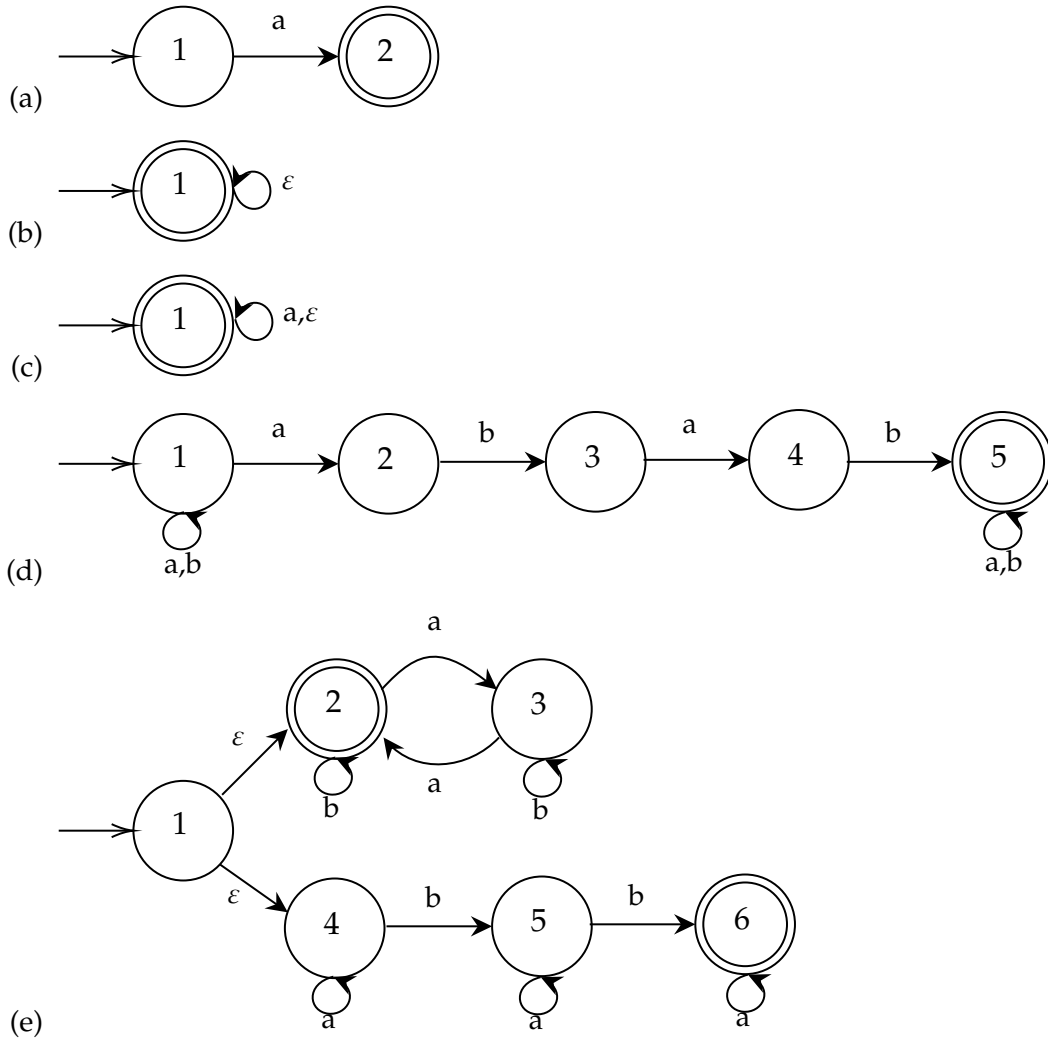


- (a) aa is not accepted, because the first a can take us from $1 \rightarrow 2 \rightarrow 6$, but from there we are stuck without a b .
- (b) aba is accepted, because we can go $1 \rightarrow 2 \rightarrow 6 \rightarrow 5 \rightarrow 1$.
- (c) abb is not accepted, because the first a can take us to 2 or 6, but from there, we cannot get back to 1 with 2 b 's. Going $6 \rightarrow 5$ needs an a , $6 \rightarrow 1 \rightarrow \emptyset$ is not accepted, $2 \rightarrow 3 \rightarrow 6$ is also not accepting.
- (d) ab is accepted, because we can go $1 \rightarrow 2 \rightarrow 6 \rightarrow 1$.
- (e) $abab$ is accepted, because we can go $1 \rightarrow 2 \rightarrow 6 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 1$.

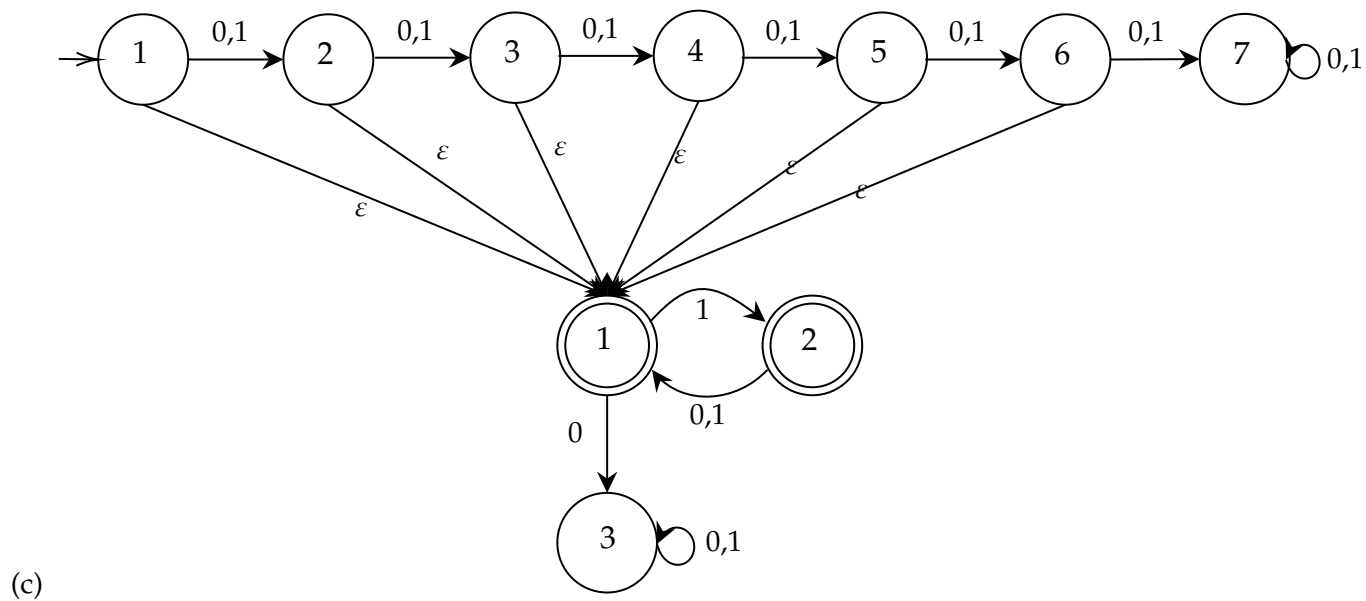
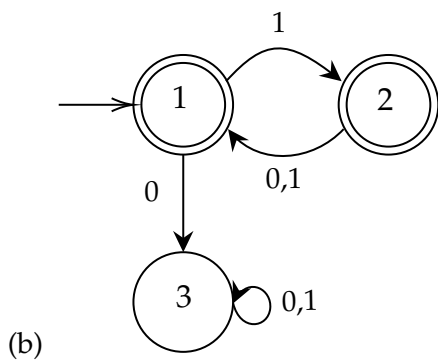
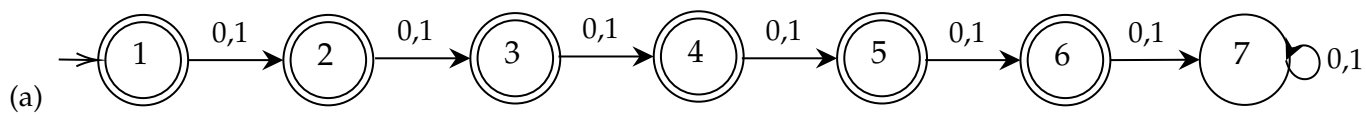
Problem 5.

$L = \{w \mid w = \text{starts with a followed by 1-3 b's OR } w = bbb\}$

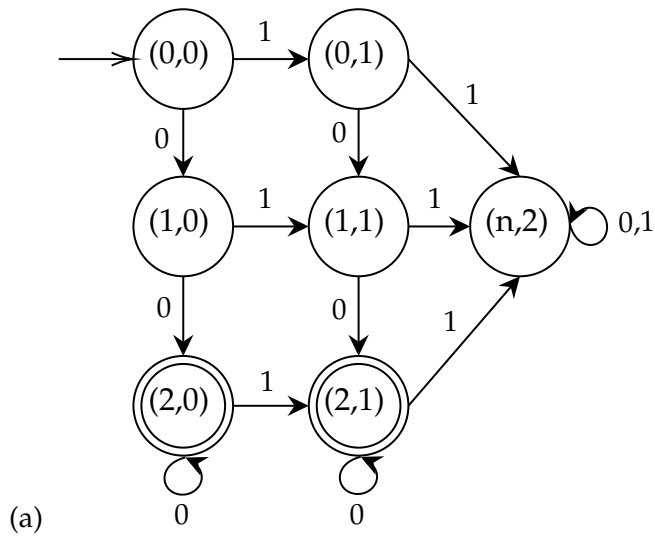
Problem 6.



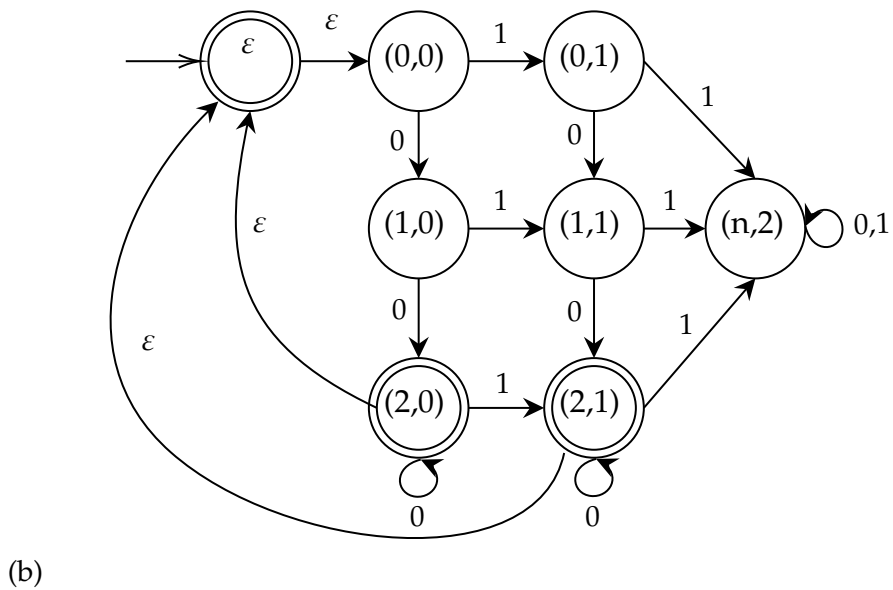
Problem 7.



Problem 8.



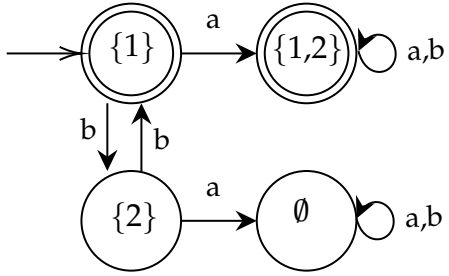
where the states are roughly organized as an ordered pair (q_1, q_2) , where q_1 represents the number of zeroes, and q_2 represents the number of ones. $(n, 2)$ is a trap state where we've exceeded the maximum number of ones (1).



Problem 9.

(a)

| δ' | a | b |
|-------------|-------------|-------------|
| $\{1\}$ | $\{1, 2\}$ | $\{2\}$ |
| $\{1, 2\}$ | $\{1, 2\}$ | $\{1, 2\}$ |
| $\{2\}$ | \emptyset | $\{1\}$ |
| \emptyset | \emptyset | \emptyset |



(b)

| δ' | a | b |
|---------------|---------------|---------------|
| $\{1, 2\}$ | $\{1, 2, 3\}$ | \emptyset |
| $\{1, 2, 3\}$ | $\{1, 2, 3\}$ | $\{1, 2, 3\}$ |
| \emptyset | \emptyset | \emptyset |

