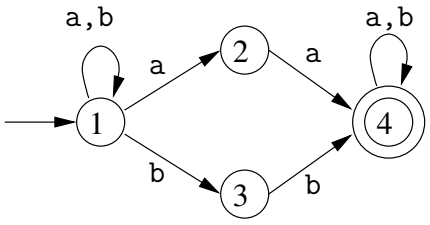
Homework Assignment #3
Due: September 29, 2023 at 7:00 p.m.

Notation: If a is a character and i is a natural number, then x^i represents the string obtained by concatenating i copies of a together. For example, $\texttt{c}^7 = \texttt{ccccccc}$ and $\texttt{c}^0 = \varepsilon$.

1. Consider the following NFA.



[2] **(a)** Give a simple English description of the strings that are accepted by the NFA.

[3] **(b)** Use the subset construction to draw the transition diagram of a DFA that accepts the same strings as the NFA. Label the states of your DFA so that it is clear how you applied the construction.

2. An NFA is called *singular* if it has just one accepting state and no ε-transitions.

[2] **(a)** Draw the transition diagram of a singular NFA for the language $L_1 = \{\texttt{ab, a, ba}\}$.

[2] **(b)** Draw the transition diagram of a singular NFA for the language $L_2 = \{\texttt{a}^i : i > 0\} \cup \{\texttt{b}\}$.

[3] **(c)** Prove that there is no singular NFA for the language $L_3 = \{\texttt{a}^i : i \geq 0\} \cup \{\texttt{b}\}$.
Hint: think about whether the initial state has to be an accepting state.