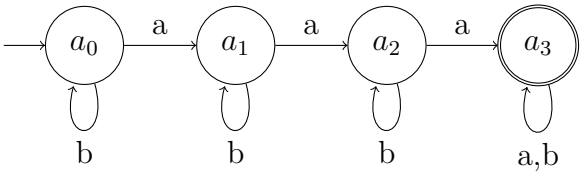
These questions are largely taken from Sipser's book [1].

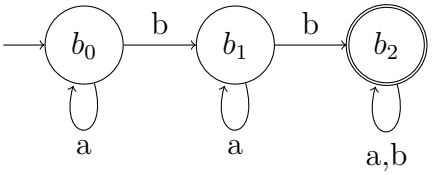
1. Draw a DFA that accepts all strings over $\{a, b\}$ that have at least three a's.

Solution:



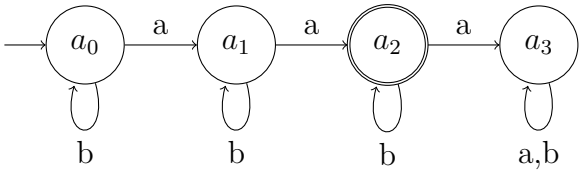
2. Draw a DFA that accepts all strings over $\{a, b\}$ that have at least two b's.

Solution:



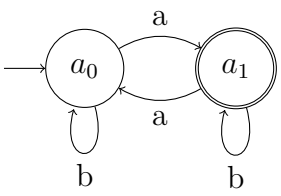
3. Draw a DFA that accepts all strings over $\{a, b\}$ that have exactly two a's.

Solution:



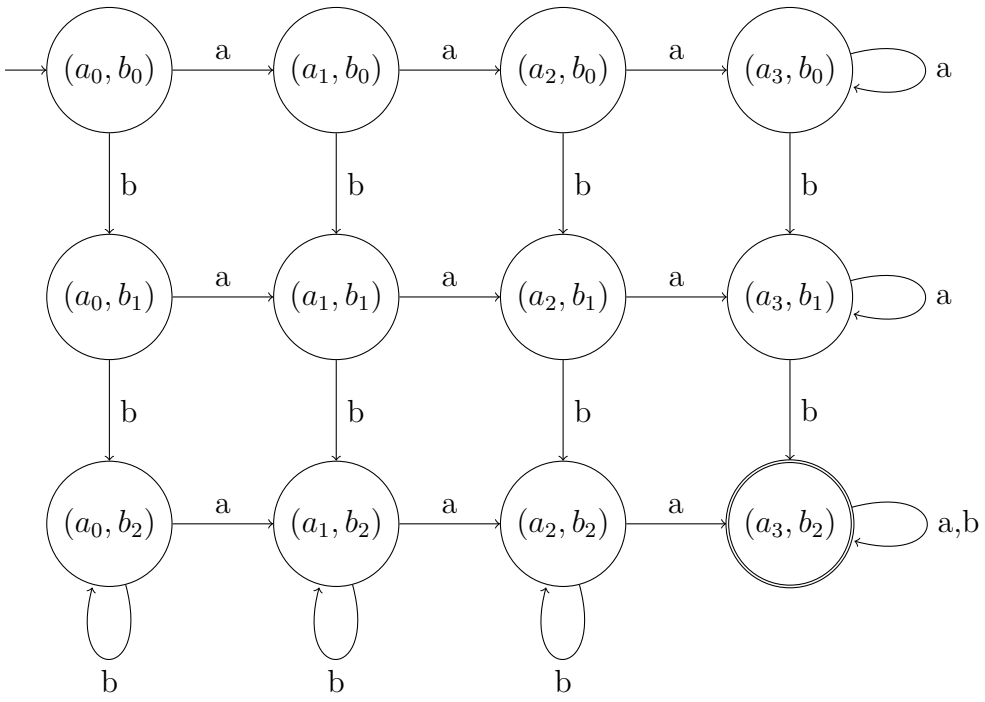
4. Draw a DFA that accepts all strings over $\{a, b\}$ that have an odd number of a's.

Solution:



5. Draw a DFA that accepts all strings over $\{a, b\}$ that have at least three a's and at least two b's.

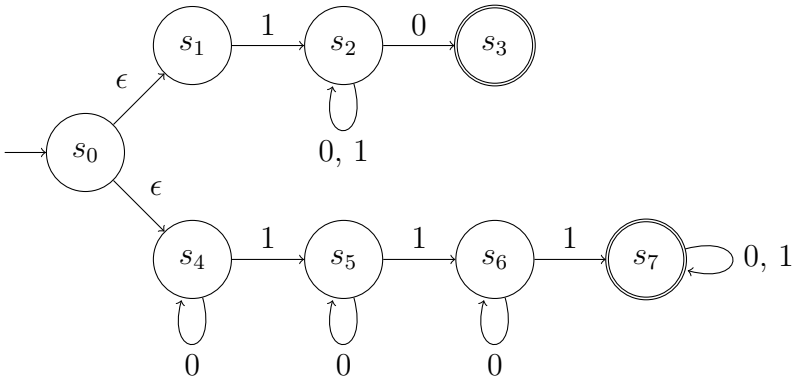
Solution:



6. Define all of the above automata.

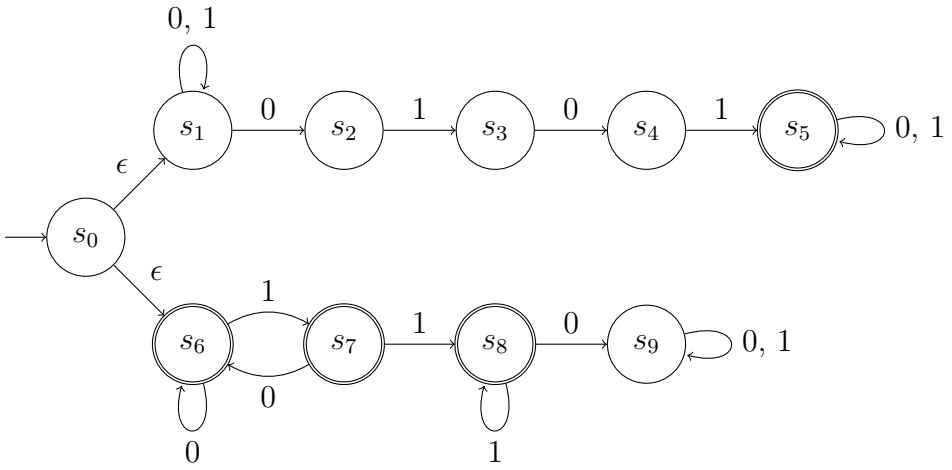
7. Draw an NFA that recognises, over the alphabet $\{0, 1\}$, both strings that begin with a 1 and end with a 0 and strings that contain at least three 1's.

Solution:



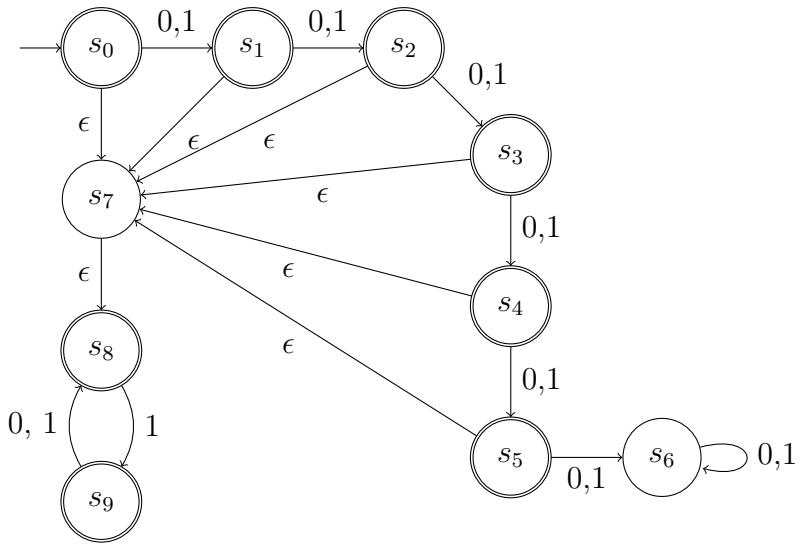
8. Draw an NFA that recognises, over the alphabet $\{0, 1\}$, both strings that contain the substring 0101 and strings that don't contain the substring 110.

Solution:



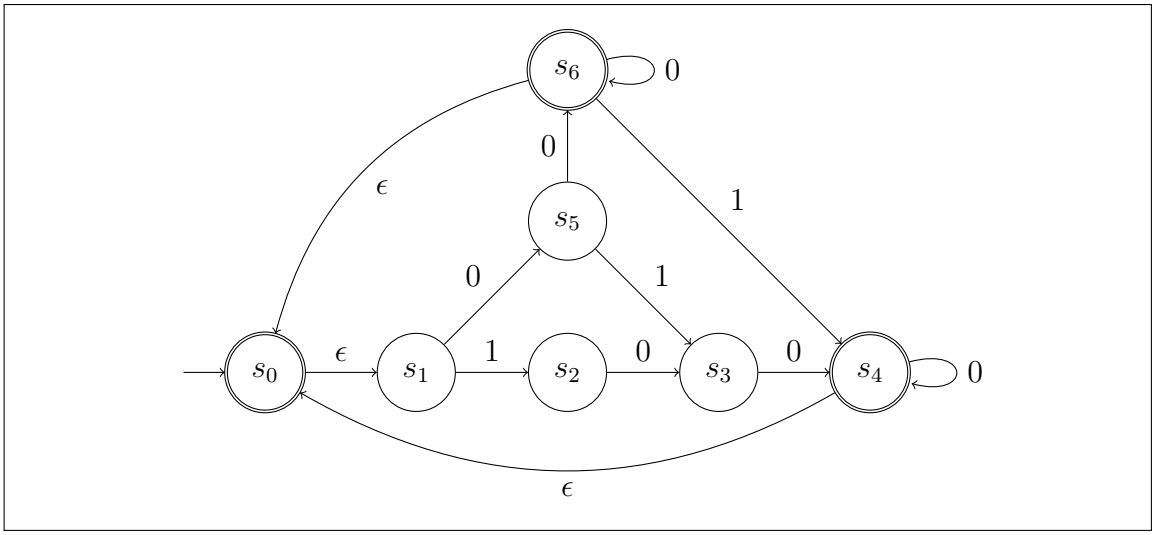
9. Draw an NFA that recognises, over the alphabet $\{0, 1\}$, the concatenations of strings of length at most five and strings where every odd position is a 1.

Solution:



10. Draw an NFA that recognises, over the alphabet $\{0, 1\}$, the Kleene star of the language containing strings with at least two 0's and at most one 1.

Solution:



References

[1] Michael Sipser. *Introduction to the Theory of Computation*. International Thomson Publishing, 3rd edition, 1996.