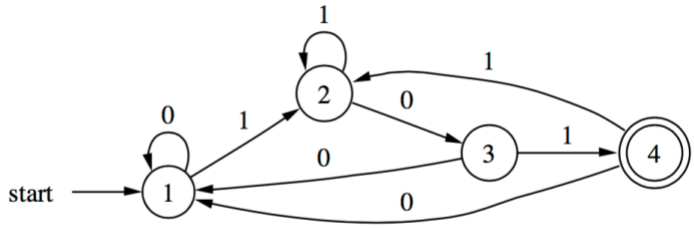
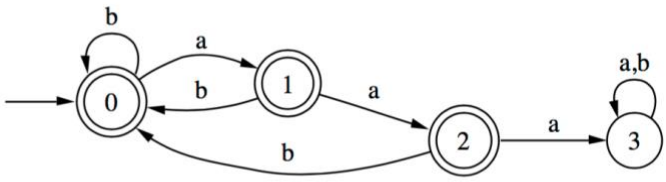
CIS 301 Theory of Computation Exam 1

1. Give a simple description of the languages recognized by the following DFA.

a.



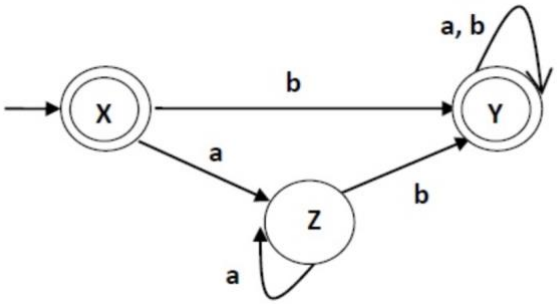
b.



2. Prove that the language of strings that contain both 010 and 101 as substrings over the binary alphabet are regular by constructing a DFA:

3. Design an NFA over the alphabet {0, 1, 2, 3} which accepts all words such that some letter occurs at least twice. For example, the NFA must accept 010 and 102311101, but not 123 or 1234.

4. Find a regular expression that describes the language accepted by the following DFA.



5. Assume we have the alphabet Σ = {0, 1}, and consider the following languages over Σ.
   L_1 = {ε, 01,1} L_2 = {0,01,10}

   1. Write $L_1 \cup L_2$ as a set of strings
   2. Write $L_1.L_2$ as a set of strings

6. State if the following statements are True or False. Explain your answer briefly.

   A. If L , $L' \subseteq \Sigma^*$, and both L and L' are infinite, then $L \cap L'$ is also infinite.

   B. The transition function of a DFA is of the form $\delta : Q \times \Sigma \rightarrow 2^Q$.

   C. If L is regular, then $L' = \{aw \mid w \in L\}$ is regular.