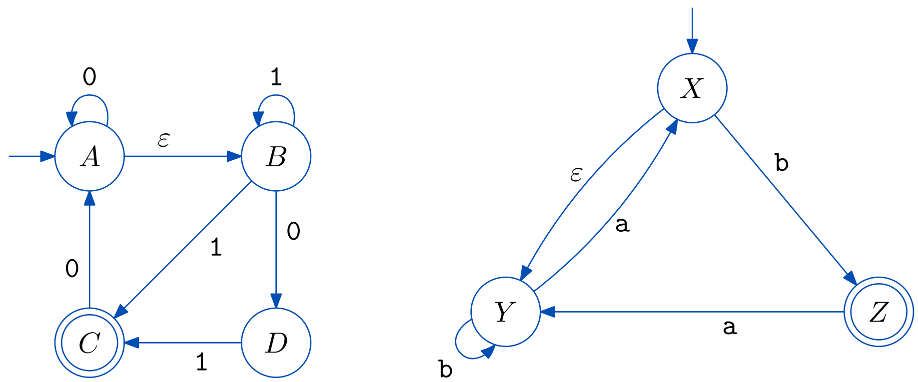
Supplemental Questions on: Regular Languages

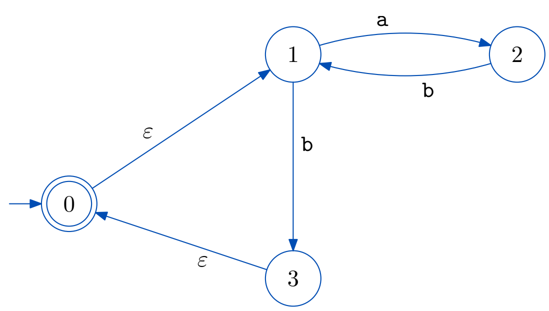
B1: (a) For the **leftmost** NFA below, use the **subset construction** to give a DFA that is equivalent to it.

(b) For the **rightmost** NFA below, use the GFA approach to construct an RE that is equivalent to it.



B2: Suppose language L is accepted by FA M. Define L^E as the set of all strings in L that have even length. Explain how to construct an FA that accepts L^E.

B3: Apply the subset construction to produce a DFA that accepts the same language as the following NFA.



B4: (a) Given language L, the language L^F is defined as the set of all **final segments** of strings in L. For example, if $L = \{\texttt{DO}, \texttt{GOOD}\}$, then $L^I = \{\texttt{DO}, \texttt{O}, \varepsilon, \texttt{GOOD}, \texttt{OOD}, \texttt{OD}, \texttt{D}\}$. Provide an algorithm that converts an FA for language L to one for language L^F.

(b) For a language L, let L^o be the set of all strings obtained from all strings of L by omitting one symbol from the string. For example, if L contains `dog`, then L^o contains `og`, `dg`, and `do`. Show how to build an FA for L^o given an FA for L.

(c) Given a string z, the **sampling** of z is the string consisting of every alternate character in z, starting with the first. For example, the sampling of `Goddard` is `Gdad`. Describe an algorithm that converts a DFA for language L to an FA for the set of all samplings of strings in L.

B5: (a) Give an example of nonregular languages L_1 and L_2 such that $L_1 \cup L_2$ is regular.
(b) Give an example of a regular language such that any DFA accepting it requires at least 100 states.

B6: Explain how to tell whether a language is Σ^* or not:

(a) Given a DFA for the language.

(b) Given an RE for the language.

B7: Give a biggest possible set of **pairwise distinguishable** strings with respect to:

(a) the set of all binary strings containing `110` as a substring.

(b) the set of all binary strings not containing `000` as a substring.

(c) the set of all binary strings starting with `011`.

B8: Use the **Pumping Lemma** to show that the following languages is not regular: $\{ 0^n 1^n 0^n : n \geq 10 \}$.

B9: Consider the language $B = \{\mathtt{0}^n \mathtt{1}^n : n \geq 0\}$ and let C be a subset of B. Use the Pumping Lemma to show that if C is infinite, then C is not regular.

B10: Let L be the language corresponding to the RE $(\mathtt{0}+\mathtt{1})^*(\mathtt{00}+\mathtt{11})(\mathtt{0}+\mathtt{1})^*$.
Find a set of maximum size of strings that are pairwise distinguishable with respect to L.