1. Create a nondeterministic finite automaton to accept all strings of 0’s and 1’s that start and end in the same symbol.

2. Convert the nfa in Item 1 to a dfa.

3. Describe in English the set of strings \( \{10^n10^n | n \geq 1\}^* \). List all strings in the set of length ten or less.

4. Let \( S = \{10^n10^{n+1} | n \geq 1\} \). What is the set \( 10S^* \cap S^*10^* \)?

5. Using \( S_1 = \{10^n10^{n+1} | n \geq 1\} \) and \( S_2 = \{10^n10^{2n} | n \geq 1\} \), write an expression for the set

\[
S = \{1010^210^310^610^710^{14} \ldots 10^{2^n+2^n-1} | n \geq 1\} \cup \{1010^210^310^610^710^{14} \ldots 10^{2^n+1+2^n-2} | n \geq 1\}.
\]

Each even numbered block of 0’s has one more 0 than the previous block and each odd numbered block of 0’s has twice as many 0’s as the previous block.