CS 4810 Homework Assignment 2 due Friday class Sept 13

1. Is the collection of all finite cardinality sets of finite length strings of 0's and 1's countably or uncountably infinite? What about the collection of all sets of finite length strings of 0's and 1's? This second collection of sets contains infinite cardinality sets of finite length strings. Prove your answers to the both questions.

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

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

   Each odd numbered block of 0's has one more 0 than the previous block and each even numbered block of 0's has twice as many 0's as the previous block. The last block has 3, 6, 7, 14, 15, 30, ..., number of 0's.