CS345/541 **Assignment 2 (partial)** Fall 2023
MA345

Given: Tue, Sep 12
Due: Fri, Sep 22, 9:00 a.m.

1. Give a formal description of the DFA of Figure 2.17, p. 23, in the notes. Describe the transition function by using equations.

2. This exercise asks you to show that DFA's can compare numbers when the numbers are presented in a particular way. For example, to compare 782 and 693, you would give to the DFA the input string that results from alternating the digits of the two numbers: 768923.

   So design a DFA that when given two numbers x and y in this way determines if $x \geq y$. For example, the DFA should accept 768923 because $782 \geq 693$. But the DFA should reject 559913 because $591 < 593$.

   More precisely, design a DFA that recognizes the following language: the set of strings of the form $x_{n-1}y_{n-1}\cdots x_1y_1x_0y_0$ such that $n \geq 1$ and if x is the number represented by $x_{n-1}\cdots x_1x_0$ and y is the number represented by $y_{n-1}\cdots y_1y_0$, then $x \geq y$.

   Note that the empty string and all strings of odd length should be rejected. The alphabet for this problem is the set of all digits, 0 through 9.

   Hint: If you find it difficult to draw the DFA, don't forget that you can give a formal description and describe the transition function with equations. If useful, describe in words the role that each state plays in your DFA.