This test has two pages. Please write your name, the course number and “Test 1” on the exam booklet.

Books, notes, calculators, computers and phones are not permitted. Work on the questions in the order that you want, but try to write your answers in order in the booklet.

Hand in your copy of the exam. Place it in the booklet. You’ll get it back.

1. (16%) Give a DFA for the language of strings that contain an odd number of 1’s (and any number of 0’s). The alphabet is \{0, 1\}.

2. (16%) Give an NFA for the language of strings that end in either 01 or 10. The NFA should have no more than five states and six transitions. The alphabet is \{0, 1\}.

3. (16%) Give a DFA or NFA for the language of strings of length exactly four. The alphabet is \{0, 1\}.

4. (16%) Suppose that \(N = (Q, \Sigma, \delta, q_0, F)\) is an NFA (with \(\epsilon\) transitions) and that \(w = w_1 \cdots w_n\) is a string of length \(n\) over \(\Sigma\). What exactly does it mean for \(N\) to accept \(w\)? Give a formal definition.
5. (16%) Consider the languages recognized by the two DFA's given below. Use the pair construction algorithm to obtain a DFA for the intersection of those two languages. Draw the resulting DFA. The alphabet is \{0, 1\}.

6. (20%) Convert the following NFA into an equivalent DFA. Use the algorithm we learned in class.