

ECE 606, Fall 2021, Assignment 9
Due: Tuesday, November 16, 11:59pm

Submission: submit your written solutions to crowdmark. There are no **[python3]** problems in this assignment.

1. Draw an NFA of at most 7 states for the following language: bit strings of length ≥ 2 in which the first bit is the same as the second-from-last bit.

By “bit strings,” I mean that the alphabet is $\{0, 1\}$. Two examples of strings that should be accepted by your NFA: 00 and 11010. Five examples of strings that should be rejected by your NFA: 101, 11101, 0, 1 and the empty string.

2. Prove, for the language of Problem (1), that a DFA of 7 or fewer states does not exist.
3. Consider the problem: given as input an array $A[1, \dots, n]$ of n integers, where n is a positive integer, output **true** if A is sorted non-decreasing, and **false** otherwise.

Prove that any (correct, deterministic) algorithm for the problem runs in time $\Omega(n)$.

4. Consider the following problem: given as input a positive integer $n > 2$, is n a composite (i.e., non-prime) number? Write pseudo-code for a non-deterministic polynomial-time algorithm for the problem. Include a brief argument for correctness and why you claim that it is polynomial-time.