

**Homework 4 — Due: Tuesday, September 27, 2022**

**Please submit your work on Brightspace, in PDF format only.**

1. Construct an NFA that accepts the set of binary strings beginning with 010 or ending with 110.
2. Construct an NFA that accepts the following language: The set of binary strings that contain at least three occurrences of substring 010.
3. Construct an NFA that accepts the following language:

$$\{0^n 10^m 10^q \mid q \equiv nm \pmod{5}\}.$$

4. Prove that, if  $M_1$  and  $M_2$  are DFAs over alphabet  $\Sigma$ , then there exists a DFA  $M$  over  $\Sigma$  such that  $M$  recognizes the following language:

$$\{w \mid w = a_1 b_1 \dots a_k b_k, \text{ where } a_1 \dots a_k \in L(M_1) \text{ and } b_1 \dots b_k \in L(M_2), \text{ each } a_i, b_i \in \Sigma\}.$$

5. Prove that, if  $M$  is a DFA over the single-symbol alphabet  $\Sigma = \{0\}$ , then there exist natural numbers  $m$  and  $n$  such that

$$L(M) = \{0^m 0^{kn} \mid k \geq 0\}.$$