**EECS 343: Theoretical Computer Science, Homework Exercise 5**
**due Monday, February 24, 2020 before class**

**Problem 1:** Let $A$ and $B$ be regular languages. Show that the language

$$L = \{xy \mid x \in A, y \in B, \text{ and } |x| = |y|\}$$

is context free.

**Problem 2:** Prove that the following languages are not context free.

a. $\{a^n b^m c^{n \times m} \mid n, m \geq 0\}$

b. $\{0^1 10^2 10^3 1 \cdots 0^{n-1} 10^n 1 \mid n \geq 1\}$

**Problem 3:** Prove that the following grammar that generates the language $\{ww^R | w \in \Sigma^*\}$, where $w^R$ is the reverse of $w$, is not an LR($k$) grammar for any fixed constant $k$.

$$S \to 0S0$$
$$S \to 1S1$$
$$S \to \epsilon$$