# COMS 331: Theory of Computing, Spring 2023
# Homework Assignment 6

Due at 10:00PM, Wednesday, March 8, on Gradescope.

For problems 37-41, prove that the indicated languages are not regular without using the pumping lemma. (Proofs using the pumping lemma will receive credit if they are completely correct; they will not be eligible for partial credit.)

**Problem 37.** $\{0^m 1^n \mid m \text{ is even or } m > n\}$.

**Problem 38.** $\{0^k 1^m 0^n \mid n = k + m\}$.

**Problem 39.** $\{x \in \{0,1\}^* \mid |x| \text{ is a perfect square}\}$.

**Problem 40.** $\{0^m 1^n \mid gcd(m,n) = 1\}$.

**Problem 41.** $\{xx \mid x \in \{0,1\}^*\}$.

**Problem 42.** Give the formal description for a Turing machine that accepts the language

$$\{x \mid \text{the } \#(1,x)\text{-th symbol of } x \text{ is } 1\}$$

with $\Sigma = \{0,1\}$.

**Problem 43.** Give the formal description for a Turing machine that accepts the language

$$\{1^m 0^k \mid 0 \leq k < m\}$$

with $\Sigma = \{0,1\}$.