CS/ECE 374 A (Spring 2022)
Homework 4 (due Feb 17 Thursday at 10am)

Instructions: As in previous homeworks.

Problem 4.1: For each of the following languages, determine whether it is regular or not, and give a proof. To prove that a language is not regular, you should use the fooling set method. (To prove that a language is regular, you are allowed to use known facts about regular languages, e.g., closure properties, all finite languages are regular, ...)

(a) $\{x(110)^n x^R : x \in \{0,1\}^*,\ n \geq 1\}$

(b) $\{0^i 1^j 0^k : i + k$ is divisible by 3, and k is divisible by j, and $i, j, k \geq 1\}$

(c) $\{yxx^R z : x, y, z \in \{0,1\}^*,\ |x| \geq 374\}$

(d) $\{y0^n 1^n 0^n z : y, z \in \{0,1\}^*,\ n \geq 374\}$

Problem 4.2: Give a context-free grammar (CFG) for each of the following languages. You must provide explanation for how your grammar works, by describing in English what is generated by each non-terminal. (Formal proofs of correctness are not required.)

(a) (30 pts) $\{x(110)^n x^R : x \in \{0,1\}^*,\ n \geq 1\}$

(b) (30 pts) $\{1^i 0^j 1^k : j = 2i + 3k,\ i, j, k \geq 0\}$

(c) (40 pts) $\{1^i 0^j 1^k : i + k$ is divisible by 3 and $0 \leq j \leq k\}$