CSE396, Spring 2021   Problem Set 4   Due Tue. 3/9, 11:59pm

Reading:

A reminder that the **First Prelim Exam** will be held on **Tue. Mar. 16** in class period. It will cover the domain of the first four problem sets, through this one. Although next week will include two lectures on Chapter 2, that will not be in-range of the exam. For next week, read all of section 2.1. Its content will occupy us for three weeks, but please read it as one block as lectures may not go strictly in the text's order.

Homework—part online (TopHat), part written, and all *individual work*:

(1) Using *TopHat*, the "Worksheet" titled *S21 HW4 Online Part.* There are 10 questions; again they vary in points-per but still total 20.

The other two problems are to be submitted as PDFs using the *CSE Autograder* system. The formats of HWs submitted so far have all been fine.

(2) Convert the following DFA M into a regular expression r such that $L(r) = L(M)$. No comments are needed on the final product, but you should show your work in the conversion process clearly—in particular noting any "reasonable shortcuts." (18 pts.)
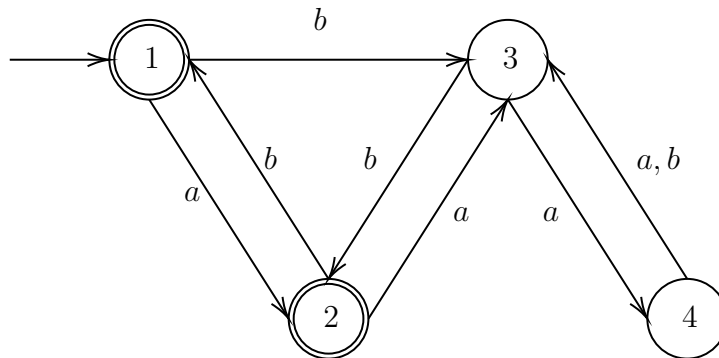
$M = (Q, \Sigma, \delta, s, F)$ with $Q = \{1, 2, 3, 4\}$, $\Sigma = \{a, b\}$, $s = 1$, $F = \{1, 2\}$, and $\delta = \{(1, a, 2), (1, b, 3), (2, a, 3), (2, b, 1), (3, a, 4), (3, b, 2), (4, a, 3), (4, b, 3)\}$.

(3) Prove that the following three languages are non-regular via the Myhill-Nerode Theorem. All use alphabet $\Sigma = \{0, 1\}$. Here x^R stands for x reversed, e.g. $0111^R = 1110$. The condition $x = x^R$ means that x is a *palindrome*, but the members of L_a are a little more restrictive, including 1001 but not 10001. For L_c, be careful that if you leave out any trailing zeroes in your strings "xz" or "yz," that counts as having $k = 0$. ($3 \times 12 = 36$ pts., for 74 total on the set)

(a) $L_a = \{xx^R : x \in \Sigma^*\}$.

(b) $L_b = \{x \in \Sigma^* : \#0(x) > \#1(x)\}$.

(c) $L_3 = \{0^i 1^j 0^k : i = j \text{ or } i \neq k \ (i, j, k \geq 0)\}$.