HW 04 CMSC 452 Morally Due TUES Feb 25 11:00AM Dead-Cat Due THU Feb 27 at 11:00AM

(30 points) (HINT: DO NOT use the algorithm that, given a DFA, finds the regex for it.)
Let the alphabet be Σ = {a, b}.

Give a regex for the following.

- (a) $\{w \colon \#_a(w) \equiv 0 \pmod{3}\}$ (example: *aaababaa*)
- (b) $\{w \colon \#_a(w) \equiv 1 \pmod{3}\}$ (example: *aaababaaa*)
- (c) $\{w: \#_a(w) \equiv 2 \pmod{3}\}$ (example: *aaabaabaaa*)

2. (30 points) Let $n \ge 11$.

Assume that the sequence

- $10^0 \pmod{n}$,
- $10^1 \pmod{n}$,

: :

has the pattern:

 $(a_0,\ldots,a_{L-1},\overline{b_0,\ldots,b_{m-1}}).$

(You can assume the b_i 's are nonzero.)

Give an UPPER BOUND on the number of states in the DFA-classifier for mod n. Explain your upper bound.

(You DO NOT NEED TO and probably SHOULD NOT be to clever. That is, you do not want to use that the first tier has 10 states. You can assume it has n states.)

3. (40 points)

- (a) Find a value of n such that the sequence $10^0 \pmod{n}$, $10^1 \pmod{n}$, \vdots \vdots has the pattern: $(a_0, \dots, a_{L-1}, \overline{b_0, \dots, b_{m-1}})$. with $L \ge 3, \ m \ge 3$, and the b_i 's are nonzero.
- (b) Give a table for a DFA classifier mod n.