HW 6 CMSC 452. Morally DUE Oct 14

1. (10 points) What is your name? Write it clearly. Staple your HW. When is the midterm?

2. (30 points) Prove that the number of regular languages is countable.

3. (30 points)

   (a) We first RESTATE the pumping theorem we did in class: We showed:

   If L is regular then there exists a constant c such that, for all strings $w \in L$, with $|w| \geq c$, there exists x, y, z with $y \neq e$ such that (1) $w = xyz$, and (2) $(\forall i \geq 0)[xy^iz \in L]$.

   YOU will show the following stronger version:

   If L is regular then there exists two constants n_0, n_1 such that, for all strings $w \in L$, with $|w| \geq n_0$, there exists x, y, z with $y \neq e$ AND $|x| \leq n_1$ such that (1) $w = xyz$, and (2) $(\forall i \geq 0)[xy^iz \in L]$.

   (b) Show that $\{w \mid n_a(w) = n_b(w)\}$ is NOT regular by using the stronger pumping theorem and NOT using closure properties.

4. (30 points) For each of the following say if it is regular or not and prove your statement.

   (a) $L_1 = \{a^n \mid (\exists s \geq n)[s \text{ is square }]$.

   (b) $L_2 = \{a^n \mid (\exists s \leq n)[s \text{ is square }]$.

   (c) $L_3 = \{a^{\lfloor \log_2(n) \rfloor} \mid n \geq 100\}$.

   (d) $L_4 = \{a^{\lfloor \log_2(n) \rfloor} \mid n \leq 100\}$.

   (e) $L_5 = \{xyx^R \mid x, y \in \Sigma^*\}$.