CS 334 Fall 2015 Homework 2 (100 points) NAME:

Regular Languages, Regular Expressions, & The Pumping Lemma

Due 11:59pm Sunday, October 4, 2015
All problems from Sipser, 3rd edition, page 83-88.
Remember to include the pledge in your submission.

(10 points) 1.16 b
(20 points) 1.21 a,b
(20 points) 1.29 a,b
(10 points) 1.41 (As an example, if A={apple, angry, archer} and B={banana, bellicose, baker}, then "applebakerangrybanana" is in the perfect shuffle of A and B, but "appleangrybakerbanana" is not.)
(10 points) 1.51 (Consider the language described by the regular expression $1^*01^*01^*$). Strings 010 and 001 are indistinguishable, but 010 and 101 *are* distinguishable.)
(10 points) Prove or disprove: Every finite language is regular.
(10 points) 2.4 c,e
(10 points) 2.9

(10 point bonus) A mouse starts at the origin (0,0) and walks along the lattice points in the real plane with integer coordinates in search of cheese placed at (x, y):

The language of strings over $\Sigma = \{N, S, E, W\}$ describes such walks.

Let $M_{(x,y)}$ be the language of "solutions" to the mouse's dilemma. That is, $M_{(x,y)}$ consists of all strings, s, in which $|N| - |S| = y$ and $|E| - |W| = x$, where $|a|$ is the number of occurrences of $a \in \Sigma$ in s.

Is $M_{(x,y)}$ a regular language? Prove your answer.

Suppose a piece of Emmental, a hard Swiss cheese with holes in it, is placed at (5,3).

$NNNEEEEE \in M_{(5,3)}$	Up and over. Munch munch munch.
$ENENENEE \in M_{(5,3)}$	Zig-zag! Nom nom nom!
$SSSWWW \notin M_{(5,3)}$	Hungry mouse at (-3,-3)
$NWSE \notin M_{(5,3)}$	Silly mouse back where she started–famished!
$NNNNEEEEEESSWWNE \in M_{(5,3)}$	Dizzy mouse looped around and found a snack.