

### Weekly Proof Questions (Section 4.1)

Assigned: 2/26/2015

Due: 3/5/2015

- 1) Let  $ALL_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA that recognizes } \Sigma^* \}$ . Show that  $ALL_{DFA}$  is decidable.
- 2) Let  $INFINITE_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA and } L(A) \text{ contains an infinite number of strings} \}$ . Show that  $INFINITE_{DFA}$  is decidable.
- 3) Let a 2-PDA be a pushdown automata with access to 2 stacks. (In each transition, we can read the top of both stacks and push something on top of both stacks, if we choose.)
  - a) Give an example of a language that is NOT context free that can be accepted by a 2-PDA. Briefly describe in words how this 2-PDA would operate to accept that language.
  - b) Show that a standard Turing Machine can be implemented using a 2-PDA.
- 4) Let  $PERFECT = \{ n \mid n \text{ is a perfect number} \}$ . A perfect number is one for which the sum of its proper divisors equals itself. For example, 28 is perfect because  $1 + 2 + 4 + 7 + 14 = 28$ . Show that PERFECT is decidable. Do some background research and see if you can answer the following question: Is PERFECT a regular language? Why or why not?