8 Homework

Due: Thursday, March 21, 2013.

Instructions

- Please, review the homework grading policy outlined in the course information page.
- On the *first page* of your solution write-up you *must* make explicit which problems are to be graded for regular credit, which problems are to be graded for extra credit, and which problems you did not attempt. Use a table that looks like this:

Problem	1	2	3	4	5	6	7	8	9	...
Credit	RC	RC	RC	EC	RC	EC	NA	NA	EC	...

  where "RC" denotes "regular credit", "EC" denotes "extra credit", and "NA" denotes "not attempted". Failure to include such a table will result in an arbitrary set of problems being graded for regular credit, no problems being graded for extra credit, and a 5% penalty assessment.
- You must also write down with whom you worked on the assignment. If this varies from problem to problem, write down this information separately with each problem.

Problems

Required: 5 of the following 7 problems
Points: 20 points per problem

1. Do the Problem 4.2

   Consider the problem of determining whether a DFA and a regular expression are equivalent. Express this problem as a language and show that it is decidable.

2. (a) Do the Problem 4.4

   Let $A_{\epsilon_{CFG}} = \{< G > | G \text{ is a } CFG \text{ that generates } \epsilon\}$. Show that $A_{\epsilon_{CFG}}$ is decidable.

   (b) Do the problem 4.7

   Let $\mathcal{B}$ be the set of all infinite sequences over $\{0,1\}$. Show that $\mathcal{B}$ is uncountable using a proof by diagonalization.

3. Do the Problem 4.11

   Let $INFINITE_{PDA} = \{< A > | A$ is a PDA and $L(A)$ is an infinite language$\}$. Show that $INFINITE_{PDA}$ is decidable.

4. Do the Problem 4.13

   Let $A = \{< R, S > | R$ and S are regular expressions and $L(R) \subseteq L(S)\}$. Show that A is decidable.

5. Do the Problem 4.17

   Prove that EQ_DFA is decidable by testing the two DFAs on all strings up to a certain size. Calculate a size that works.

6. Do the Problem 4.21

   Let $S = \{< M > | M$ is a DFA that accepts w^R whenever it accepts $w\}$. Show that S is decidable.

7. Do the Problem 4.30

   Let A be a Turing-recognizable language consisting of descriptions of Turing machines $\{< M_1 >, < M_2 >, ...\}$, where every M_i is a decider. Prove that some decidable language D is not decided by any decider M_i whose description appears in A. (Hint: You may find it helpful to consider an enumerator for A).