

Homework 08

Due: Friday, April 7, 2006

Instructions

1. Please review the homework grading policy outlined in the course information page.
2. 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.

3. 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: 4 of the following 5 problems

Points: 25 points per problem

1. Do Exercise 5.1 using a mapping reduction. *Hint:* Use the result stated in Theorem 5.13, even though we didn’t (and won’t) cover this result or its proof in class.
2. Do Problem 5.9 using a mapping reduction.
3. Use a mapping reduction to prove that

$$DECIDER_{TM} = \{\langle M \rangle \mid M \text{ is a TM and } M \text{ is a decider}\}$$

is undecidable.

4. Use a mapping reduction to prove that

$$EVEN_{TM} = \{\langle M \rangle \mid M \text{ is a Turing machine that accepts only even-length strings (if any)}\}$$

is undecidable.

5. Prove that $REGULAR_{TM}$ (defined in class and on p. 191 of Sipser) is neither Turing-recognizable nor co-Turing-recognizable. *Hint:* For part of this you should create one new mapping reduction.

For any of these problems, where appropriate you should cite and build on (and not re-derive) any results already provided in the assigned readings or in class.