

**Harvard University
Computer Science 121**

Problem Set 8

Due Tuesday, November 12, 2013 at 11:59 PM.

Submit your solutions electronically to `cs121+ps8@seas.harvard.edu` with “ps8 submission” in the subject line. The solutions to Parts A and B should be attached as separate PDF files, called `lastname+ps8a.pdf` and `lastname+ps8b.pdf`.

Late problem sets may be turned in until Friday, November 15, 2013 at 11:59 PM with a 20% penalty.

Problem set by ****ENTER YOUR NAME HERE****

Collaboration Statement: ****FILL IN YOUR COLLABORATION STATEMENT HERE
(See the syllabus for information)****

See syllabus for collaboration policy.

PART B (Graded by Louis and Perry)

PROBLEM 1 (8+8 points)

Let $S = \{\langle M \rangle : M \text{ is a TM and } L(M) = \{\varepsilon\}\}$. By using mapping reductions:

- (A) Show that S is not recognizable.
- (B) Show that S is not co-recognizable.

PROBLEM 2 (8 points)

Let a “rep-string” be a string of the form $w = xx$ for $x \in \Sigma^*$. Consider the language $L = \{\langle G \rangle : G \text{ is a CFG and } L(G) \text{ contains a rep-string}\}$. Prove that L is undecidable.

PROBLEM 3 (4+4 points)

In the near future you’re working as an engineer, when your manager asks you to write the following two programs. Is this a problem? Why or why not?

- (A) Take another program’s code as input and decide if that program is implemented in the fewest possible lines of code.
- (B) Take another program’s code and remove all inaccessible (dead) code from it.