Introduction to Computer Science Theory (4003-380-01)
Prof. Richard Zanibbi (20103, Spring 2011)
Homework 8, Due 4pm, Tuesday May 10, 2011

All questions are written for this assignment; submit them through myCourses or on paper before the start of class. If you work in a group of two, submit your answers only once, and make sure to include both your names on your submitted work.

Questions (50 points in total)

1. Show that EQ_{CFG} (the language of encoded CFG pairs $< C_1, C_2 >$ that represent the same language) is undecidable.

2. If $A \leq_m B$ (language A map reduces to language B) and B is a regular language, does this imply that A is also a regular language? Why or why not?

3. Question 4.5 parts b, c, e, and f (from 2nd edition of course textbook)

4. Let $C_{CFG} = \{< G, k > \mid L(G)\ \textit{contains exactly}\ k\ \textit{strings},\ \textit{where}\ k \geq 0\ \textit{or}\ k = \infty\}$. Show that C_{CFG} is decidable.

5. Let $PAL_{DFA} = \{< M > \mid M\ \textit{is a}\ DFA\ \textit{accepting some palindrome}\}$. Show that PAL_{DFA} is decidable. Hint: consider Theorems about CFLs.

6. Consider the problem of determining whether a Turing machine M on input w ever tries to move left when the tape head is on the leftmost tape cell. Define this problem as a language, and show that it is undecidable.

7. Show that A is recursively enumerable iff $A \leq_m A_{TM}$.