

CS500 Homework #2, Spring 2008

Note: Working with others on this homework is *allowed* and carries no penalty. However, you must do your own writeup, and you must state on your homework who you worked with. “M&M” means Mertens and Moore. Due in class or by the end of the day on Tuesday, February 19th.

1. Consider the following languages: $\{a^n b^n c^*\}$, $\{a^* b^n c^n\}$, and $\{a^n b^n c^n\}$. The first two are context-free; we argued in class (and it's proved in Sipser) that the third one is not. Use these facts to show that there are context-free languages L whose complements \overline{L} are not context-free.

Then argue that NPDAs, nondeterministic push-down automata, are strictly more powerful than DPDAs: in other words, that there are context-free languages which cannot be recognized by any DPDA. Hint: what is the easiest way to prove that the complement of a regular language is regular?

2. M&M Problem 2.1 (Brilliant Pebble's computer)
3. M&M Problem 2.4 (Fibonacci numbers in P; assume the results of Problem 2.3)
4. M&M Problem 2.11 ($T(n) = aT(n/b)$)
5. M&M Problem 2.18 (quasipolynomials)
6. M&M Problem 3.16 (Typesetting as Shortest Path)
7. M&M Problem 3.22 (beachfront property)
8. M&M Problem 3.23 (Sierpiński triangles)
9. M&M Problem 3.24 (square lattice)
10. M&M Problem 3.27 (Floyd-Warshall)
11. M&M Problem 3.30 (removing cycles from spanning trees)
12. M&M Problem 3.39 (edge-disjoint paths)
13. M&M Problem 3.40 (2-connected spanning subgraphs)
14. M&M Exercise (not Problem) 3.17 (unique maximal flows?)