

CMPS210 Final Exam 2002

5 questions

1. Prove that $\text{SPACE}(n^2)$ is different from $\text{SPACE}(n^3)$ on multi-tape TM's from scratch by proving a self-contained specialized version of the space hierarchy theorem.
2. Exercise 7.17 on page 276 (what is wrong with the G3C to Minimum Vertex-Deletion Bipartite Subgraph reduction).
3. Verify the P and Exp are closed under polynomial-time reductions, but E is not (Exercise 6.6 on page 188).
4. Prove or disprove the following:
 - a. If L^* is regular then L is regular.
 - b. If $L = L_1 + L_2$ is regular and L_2 is finite, then L_1 is regular.
 - c. Is the class of regular languages closed under infinite union?
 - d. Is the language $\{xwx^R \mid x, w \in (\mathbf{0} + \mathbf{1})^+\}$ regular?
5. A 2-stack machine has a finite state control and scans an input symbol, pops a character from each stack, and then pushes new characters onto the stacks while changing state at each step. More formally, a 2-stack machine's transition function maps a (state, input char, 1st stack char, 2nd stack char) quadruple to a (state, 1st stack replacement char, 2nd stack replacement char) triple). Assume that ε 's can be used to avoid reading the input, popping a stack and/or pushing anything new on a stack.

Prove that 2-stack machines decide the same languages as Turing Machines (like our TMs, a 2-stack Machine accepts its input by entering a special "Yes" state). You may assume that a special symbol " $\#$ " ends a the input and is "popped" when a stack is empty.