CSE 322

Intro to Formal Models in CS

Homework #2

Due: Friday 12 Oct 07

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Note on collaboration: on this and all homework assignments, you are encouraged to talk to your classmates about the problems, brainstorm, trade ideas, but you are *not* allowed to carry away written notes from these discussions, nor are you allowed to use or borrow from others' written solutions to the problems. This means searching the internet, your friends' old course files, etc. are *not* allowed. Violation of these rules will be treated as academic misconduct.

Note on text book editions: Problem numbers and pages here and in future assignments are from the *second edition* of Sipser. First edition users: proceed at your own risk. Where possible, I'll indicate the correspondence to the 1st edition. Based on preliminary scanning, the contents of the two editions look reasonably similar, but I can't promise that there won't be some critical differences.

Problems below are on pages 84-85.

1. 1.7bc. (1st ed.: 1.5bc)
2. 1.8a. (1st ed.: 1.6a)
3. 1.9a. (1st ed.: 1.7a)
4. 1.10c. (1st ed.: 1.8c)
5. 1.14. (1st ed.: 1.10) I waived my arms about this, especially part (a), in lecture. You should try to write it carefully and clearly, and explain as clearly as possible why the proof from part (a) does not extend to part (b).
6. 1.16. (1st ed.: 1.12) Show all states, transitions, etc., as specified by the construction, i.e., don't use shortcuts or "optimize" it.
7. (a) Give a formal inductive proof of the key claim needed to establish the correctness of the "Cartesian product construction" used in Theorem 1.25 (1st ed.: 1.12): For all $x \in \Sigma^*$, and all $r_1 \in Q_1, r_2 \in Q_2$, we will have M in state (r_1, r_2) after reading x if and only if M_i is in state r_i after reading x, for $i = 1, 2$.
   (b) Then use this fact to prove that $L(M) = L(M_1) \cup L(M_2)$.
   (c) Modify the construction of M slightly to prove that $L(M_1) - L(M_2)$ (i.e., the set of strings in $L(M_1)$ but not in $L(M_2)$) is also regular.