3 Homework

Due: Wednesday, October 3, 2007.

Instructions

- Please, review the homework grading policy outlined in the course information page.

- On the first page of your solution write-up you must make explicit which problems are to be graded for regular credit, which problems are to be graded for extra credit, and which problems you did not attempt. Use a table that looks like this:

| Problem | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ...
|---------|---|---|---|---|---|---|---|---|---|---
| Credit  | RC| RC| EC| RC| EC| NA| NA| EC| NA|...

where “RC” denotes “regular credit”, “EC” denotes “extra credit”, and “NA” denotes “not attempted”. Failure to include such a table will result in an arbitrary set of problems being graded for regular credit, no problems being graded for extra credit, and a 5% penalty assessment.

- You must also write down with whom you worked on the assignment. If this varies from problem to problem, write down this information separately with each problem.

Problems

Required: 5 of the following 7 problems

Points: 20 points per problem

1. Use the procedure described in Lemma 1.60 in the text to convert the following DFA to a regular expression in two different ways:

- eliminating first state 3, then state 2, then state 1
- eliminating first state 1, then state 2, then state 3
Show the resulting GNFA after each step, and do not try to simplify your answer (except for eliminating all instances of $\emptyset$ in unions and all instances of $\epsilon$ in concatenations).

2. Use the procedure described in Lemma 1.60 in the text to convert the following DFA to a regular expression in two different ways:

- eliminating first state 3, then state 2, then state 1
- eliminating first state 1, then state 2, then state 3

Show the resulting GNFA after each step, and do not try to simplify your answer (except for eliminating all instances of $\emptyset$ in unions and all instances of $\epsilon$ in concatenations).

3. Use the pumping lemma to show that the following languages are not regular.

(a) $\{w | w = a^kba^k \text{ for any } k \geq 0\}$
(b) $\{w | w = a^ib^jc^k \text{ where } i, j, k \geq 0 \text{ and either } i = j \text{ or } i = k\}$

4. Do Problem 1.46(c, d).

5. Do Problem 1.55, but for the following languages:
6. (a) Do Problem 1.47
(b) Do Problem 1.48

7. Prove or disprove the following:
   (a) Every subset of a regular language is a regular language
   (b) Every subset of a nonregular language is a nonregular language.
   (c) If $A$ is a regular language and $B$ is a language such that $AB$ is regular, then $B$ is regular.
   (d) If $A$ is a regular language and $B$ is a language such that $A - B$ is regular, then $B$ is regular.
   (e) For any language $A$ and its complement $A'$ the language $A \cup A'$ is regular.