9 Homework

Due: Wednesday, December 5, 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 | RC | EC | RC | EC | NA | NA | EC | ...

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: 4 of the following 5 problems
Points: 25 points per problem

1. a Show that $P$ is closed under complement and concatenation.

b Let $A$ be a decidable language and let $D$ be a polytime decider for it. Consider the following algorithm for deciding whether a given non-empty string $s$ of length $n$ belongs to $A^*$: For every possible way of splitting $s$ into non-empty substrings $s = s_1s_2...s_k$, run $D$ on each substring $s_i$ in that split and accept iff all substrings are accepted by $D$ for some split. Derive an exact
expression for how many possible such splits there are as a function of \( n = |s| \). Use this to conclude that this algorithm does not run in polynomial time, even though \( D \) does.

c  What does the result of part b imply about the closure of \( P \) under the star operation?

2. Do the Problem 7.10
3. Do the Problem 7.12
4. Do the Problem 7.23
5. Do the Problem 7.25