

CS 420
Study Guide for Test 2

For this test, I am listing problems in two categories, routine and non-routine. There are not that many routine problems. The non-routine ones can be semi-creative or creative depending on how they are asked.

Not all of these types of questions will appear on the test and there will probably be questions not of any of the types listed below, but this does give you a starting point for your studies. For each type of question, I have listed the homework problems you have had of that type. If the problem number is in parentheses, that means that I would not ask you any question on the test that is as hard as the problem in parentheses.

Routine Questions

1. Give the sequence of configurations entered into by a particular Turing machine on a particular input.
Homework 8, Problem 1.
2. Apply the algorithm to decide E_{DFA} to a particular DFA.
Homework 8, Problem 9.
3. Apply the algorithm to decide E_{CFG} to a particular context-free grammar.
Homework 8, Problem 10.

Non-Routine Questions

1. Describe a Turing machine at the implementation level to decide a language.
Homework 8, Problem 3.
2. Show that a variant of the Turing machine is or is not equivalent to the original definition.
Problems (3.9), 3.11.
Homework 8, Problem 6.
3. Show the closure of the decidable languages under some operation.
Problem 3.15.
4. Show the closure of the Turing-recognizable languages under some operation.
Problem 3.16.
5. Show that a problem (usually involving automata or grammars) is decidable.
Problem 5.15.
Homework 8, Problems 11, 12.
Homework 9, Problem 1, 2, 3.

6. Show that a problem is Turing-recognizable.
Homework 10, Problem 1a.
7. Show that a problem (involving automata or grammars) is co-Turing-recognizable.
8. Show that a set is countable.
Homework 9, Problems 4, 5.
9. Prove something by diagonalization.
Homework 9, Problems 6, 7,
Homework 10, Problem 1b.
10. Give a reduction between two problems.
11. Show that one problem is not mapping reducible to another.
Homework 11, Problems 6, 8.
12. Show that one problem is mapping reducible to another.
Homework 11, Problem 7.
13. Show that a problem is undecidable by reducing a known undecidable problem to it.
Problems 5.9, 5.14, (5.27)
Homework 10, Problems 1c,2,3.
14. Prove some property of mapping reducibility.
Exercise 5.4.
Problems 5.22, 5.23, 5.25.
15. Use mapping reducibility to show that some problem is undecidable or not Turing-recognizable.
Problem 5.24.