

Homework 8

Problems 1-4 — Due Thursday, October 29, 2009 before the lecture

Please refer to the general information handout for the full homework policy and options. This homework contains 3 problems for undergraduate students and 4 problems for graduate students, worth 10 points each. *Your solution to each problem should be handed in on a separate sheet of paper.* In addition, it contains a **programming assignment** (Problem 5) due **Friday, October 30 at 11:59pm** on Angel.

Reminder Collaboration is permitted, but you must write the solutions *by yourself without assistance*, and be ready to explain them orally to the instructor if asked. You must also identify your collaborators. Getting solutions from outside sources such as the Web or students not enrolled in the class is strictly forbidden.

Problems Please practice on exercises and solved problems in Chapter 5. The material they cover may appear on exams.

1. (**Short Answers**) For the following decision problems: (i) formulate each of them as a language, (ii) specify whether the language is decidable (**D**), recognizable, but not decidable (**R**), or unrecognizable (**U**), and (iii) give a short proof of your assertion.

Note: If you choose **R**, you need to prove two separate facts: (1) the language is recognizable; (2) the language is not decidable.

We would like to determine whether a given Turing machine

- (a) has at least 464 states
- (b) takes more than 464 steps on input ϵ
- (c) takes more than 464 steps on *some* input
- (d) accepts ϵ
- (e) accepts no strings at all

2. (**Mapping Reducibility**) (a) Book, 5.22, (b) Book, 5.23.

3. (**2DIM-DFA**) Book, 5.27

- 4^G. (**AMBIG_{CFG}**, required for grad students only) Book, 5.21.

5. (**Programs, 20 points, due Friday, October 30**) Give two different programs, M and N , such that, when started on any input, M prints the code of N and N prints the code of M . Your programs should be in the spirit of the recursion theorem, as discussed in class. (It is NOT Ok to make your programs almost identical with some trivial modification.)

You can use Java, C or C++. Submit your code via the drop box in Angel and provide a brief explanation of how to compile and run your code on CSE Solaris machines. If you absolutely do not know any of the programming languages listed above, you can negotiate the language with Youngtae as long as the compiler/interpreter is already installed on CSE Solaris machines.