

Homework 5 – Due Thursday, October 8, 2009 before the lecture

Please refer to the general information handout for the full homework policy and options. This homework contains 4 problems, worth 10 points each. *Your solution to each problem should be handed in on a separate sheet of paper.*

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 3. The material they cover may appear on exams.

- (TM descriptions)** In this problem, you will look at three ways of describing TMs: (a) formal, (b) implementation level and (c) high level (or a description of the underlying algorithm).
 - Book, 3.2d. Please use the same representation for your configurations as on p. 140.
 - Give implementation level description of a TM, possibly nondeterministic or with multiple tapes, that recognizes the language of all strings of the form $w_1\#w_2\#\dots\#w_n$, where $n \geq 0$, each $w_i \in \{0,1\}^*$ and, for some j , string w_j is the binary representation of the integer j .
 - Book, 3.7
 - Formulate the language that M_{bad} in part (c) was intended to recognize and describe a correct TM that recognizes this language.
- (Closure properties)** Show that the class of decidable languages is closed under
 - complement
 - starThink about union (solution on p. 163), intersection and concatenation on your own.
Show that the class of Turing-recognizable languages is closed under
 - intersection
 - concatenationThink about union¹ and star on your own.
- (k -PDA)** Book, 3.9.
- (EQ_{DFA})** Book, 4.16.
- (Optional, no collaboration)** Book, 3.19. *Hint:* Use the result of problem 3.18.

¹In the solution on p. 163, the last paragraph should begin "If either M_1 or M_2 accepts w , ...".