6.045J/18.400J: Automata, Computability and Complexity	Prof. Ron Rivest

Handout 9: Recitation Problems

7 March 2002 — *Jonathan Herzog*

Problem 1: **Warm up:** Suppose L_1 and L_2 are decidable languages. Which of the following are decidable?

- $L_1 \cup L_2$
- $L_1 \cap L_2$
- $L_1 \setminus L_2$
- $\overline{L_2}$
- L_2^*
- $L_1 \circ L_2$

What if L_1 and L_2 are recognizable? Which of the above are recognizable?

Problem 2: For the TM M_1 in exercise 3.4, give the sequence of configuration that M_1 enters into on the input strings:

- 0
- 00
- 000

Problem 3: What can be said about the language $L(M)$ in each of the following cases?

- M moves its head right on each move.
- There is some integer n such that, no matter what its input is, M never moves its head past square n.
- For at least one input string x, M accepts before moving its head to the end of x.
- M never changes any symbol on its tape.

Problem 4: Show that a language is recognizable iff it is enumerable. (Yes, we did this in class.)

Problem 5: Show that a language is recognizable iff a non-deterministic Turing machine recognizes it.