

**050.371/671 — Formal Methods in Cognitive Science**  
**Problem Set 2**  
**Due March 27, 1999**

**Problem 1 (Problem 4 from PS 1)**

For each of the following languages, state whether it is recursive, r.e. but not recursive, or neither, and provide a proof. (Take  $L(M)$  to indicate the language *accepted* by  $M$ .)

1.  $L_{ne} = \{M \mid L(M) \neq \emptyset\}$
2.  $L_e = \{M \mid L(M) = \emptyset\}$
3.  $L_a = \{M \mid M \text{ halts on all inputs}\}$

**Problem 2**

**Part A:** For two recursive languages  $L_1$  and  $L_2$ , show that  $L_1 \cup L_2$  and  $L_1 \cap L_2$  are also recursive.

**Part B:** For two r.e. languages  $L_1$  and  $L_2$ , show that  $L_1 \cup L_2$  is also r.e. Is  $L_1 \cap L_2$  guaranteed to be r.e.? Why or why not?