1. (15 pts) Rice’s theorem states that no non-monotonic property of r.e. sets is semi-decidable.
   a. Give three examples of non-monotonic properties of r.e. sets.
   b. Give three examples of monotonic properties of r.e. sets that are decidable.
   c. Give three examples of properties of turing machines that are not properties of their languages

2. (40 pts) Determine whether the following sets are (a) recursive, (b) recursively enumerable but not recursive, or (c) not recursively enumerable. Prove your answers. (Do not use Rice’s theorem.)
   a. \{M \mid L(M) \text{ is recursively enumerable}\}
   b. \{M \mid L(M)=L(M^R)\}
   c. \{M,i \mid \text{there is some input } x \text{ such } M \text{ never enter state } q_i \text{ on input } x\}
   d. \{M \mid M \text{ enter state } q_i \text{ on some input}\}

3. (30 pts) Let L_1 and L_2 be recursive languages. Classify the following problems as decidable, semi-decidable, or undecidable. Prove your answers.
   a. Is L_1\neq L_2?
   b. Is x \text{ in } L_1-L_2?
   c. Is L_1=L_2?