Quiz 2

1. Classify the following languages as:

   rec—the language is decidable.
   r.e.—the language is recursively enumerable (r.e.) by not decidable.
   co-r.e.—the complement of the language is r.e., but the language is not decidable.
   neither—the language is neither r.e. nor co-r.e..

   No justification wanted or necessary.

   (a) $L = \{\langle M \rangle : \ M \text{ is a TM and } L(M) \text{ contains a palindrome}\}$.

   (b) $L = \{\langle P \rangle : \ P \text{ is a C-program and } P \text{ halts on input of itself}\}$.

   (c) $L = \{\langle M, M' \rangle : \ M \text{ and } M' \text{ are Turing machines that accept the same language}\}$.

   (d) $L = \{\langle G \rangle : \ G = (V, \Sigma, R, S) \text{ is a CFG and } L(G) = \Sigma\}$.

   (e) $L = \{\langle G \rangle : \ G = (V, \Sigma, R, S) \text{ is a CFG and } L(G) = \Sigma^*\}$.

2. Prove that the following language is undecidable:

   $L = \{\langle M, q \rangle : \ M = (Q, \Sigma, \Gamma, \delta, q_0, q_A, q_R) \text{ is a TM and } q \in Q \text{ and } M \text{ never enters state } q\}$.