Theory of Computation
Homework 8.

Due Date: Thursday, November 11.

1. Let Rec-GNFA = \{⟨M, w⟩ | M is a GNFA and w ∈ L(M)\}
   Show that Rec-GNFA is decidable.

2. (a) Show that if \( R \subseteq S \) if and only if \( R \cap \overline{S} = \emptyset \).
   (b) Let Rec-Contain = \{⟨MR, MS⟩ | MR and MS are DFAs recognizing regular
       languages \( R \) and \( S \) respectively, and \( R \subseteq S \)\}.
       Show that Rec-Contain is decidable.
       Hint: Use a reduction to Empty-DFA.

3. Let Eq-DFA-NFA = \{⟨M, N⟩ | M is a DFA and N
       is an NFA with \( L(M) = L(N) \)\}.
   Show that Eq-DFA-NFA is decidable.

4. Let Eq-Rev = \{⟨M⟩ | M is a DFA, \( L = L(M) \), \( M^R \) is an NFA recognizing \( L^R \),
       and \( L(M) = L(M^R) \)\}.
   Show that Eq-Rev is decidable. You may assume the result of Chapter 2, No. 8.

5. Let Pumpable = \{⟨M⟩ | M is a DFA,
       and for every \( w \in L(M) \), \( w \) is pumpable\}.
   Show that Pumpable is decidable.
   Hint. What can you say about M’s graph if every string it recognizes is pumpable?
   Your algorithm needs to test this property.