

CS341 Automata Theory
Homework Assignment #7

Do not forget to write your name and EID.

1. Sipser 5.14
2. For the following languages, state whether each is (I) decidable, (II) semi-decidable but not decidable, or (III) not semi-decidable. Prove your answer.
 - (a) $L = \{ \langle M_1, M_2 \rangle \mid M_1, M_2 \text{ are TMs and } \varepsilon \in L(M_1) \cap L(M_2) \}$
 - (b) $L = \{ \langle M_1, M_2 \rangle \mid M_1, M_2 \text{ are TMs and } \varepsilon \in L(M_1) - L(M_2) \}$
 - (c) $L = \{ \langle M, x, k \rangle \mid M \text{ is a TM, and } M \text{ does not halt on } x \text{ within } k \text{ steps} \}$
 - (d) $L = \{ \langle M \rangle \mid M \text{ is a TM, and } L(M) \text{ is countable} \}$
3. Let $S = \{ \langle M \rangle \mid M \text{ is a TM that accepts } w^R \text{ whenever it accepts } w \}$. Show that S is undecidable.