

Homework 4—CSC 320 Summer 2015

Due in class, Tuesday July 21, at 11:20am

1. Prove that the language

$L = \{\langle M \rangle \mid M \text{ when started on the blank tape, eventually writes a \$ somewhere on the tape}\}$
is undecidable. Use the undecidability of A_{TM} to do this.

2. Give a reduction from

$$HALT_{TM} = \{\langle M, w \rangle \mid M \text{ is a TM which halts on } w\}$$

to

$$L = \{\langle M, j \rangle \mid M \text{ halts on all inputs with less than } j \text{ 1's}\}.$$

Prove it's a reduction.

3. Show that $\overline{E_{TM}}$ is recognizable by giving a high level description of a nondeterministic TM which recognizes it.
4. Show that $\{\langle M_1, M_2 \rangle \mid L(M_1) \cap L(M_2) = \emptyset\}$ is not recognizable. Use E_{TM} .
5. Say a TM M is *reversible* if for every string w , M accepts w iff M accepts the reverse of w . (Recall that the reverse of $w_1 w_2 \dots w_k$ is $w_k w_{k-1} \dots w_1$.) Prove that the language

$$T = \{\langle M \rangle \mid M \text{ is a reversible TM}\}$$

is undecidable.