Problem Set 5

This problem set is due on Friday March 5, by 4:00pm.

Use the CS172 drop box.

Write your name and your student ID number on your solution. Write legibly. The description of your proofs should be as clear as possible (which does not mean long – in fact, typically, good clear explanations are also short.) Be sure to be familiar with the collaboration policy, and read the overview in the class homepage www.cs.berkeley.edu/~luca/cs172.


3. (a) Prove that $E_{TM}$ is Turing-recognizable.
   (b) Prove that $A_{TM}$ is not mapping reducible to $E_{TM}$.

4. For each of the following languages, give a proof that it is undecidable or describe an algorithm to decide it. (You may assume that all the languages are over the alphabet \{0, 1\} and all the Turing machines have \{0, 1\} as their input alphabet.)

   (a) $L_1 = \{ \langle M \rangle \mid M$ is a Turing machine that rejects all inputs of even length\}.
   (b) $L_2 = \{ \langle M \rangle \mid M$ is a Turing machine that halts on an empty input\}.
   (c) $L_3 = \{ \langle M \rangle \mid$ there is some input $x \in \{0, 1\}^*$ such that $M$ accepts $x$ in less than 100 steps $\}.$

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