Problem Set 6

This problem set is due on **Friday March 12, 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`.

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1. Sipser problem 5.9.
2. Sipser problem 5.12. Prove the result using Rice's theorem: show that $S = L_{\mathcal{C}}$, for a properly defined $\mathcal{C}$, and show that S is non-empty and does not contain all Turing machines.
3. (a) Suppose B is an undecidable language such that $B \leq_m \overline{B}$. Prove that neither B nor $\overline{B}$ is Turing-recognizable.

   (b) (Sipser problem 5.11) Give an example of an undecidable language B where $B \leq_m \overline{B}$. (A correct example of such a language without proof will get zero credit; a complete solution should include an explicit mapping reduction from B to $\overline{B}$ and a proof that B is undecidable.)
4. Sipser problem 6.11.