Problem Set 4

This problem set is due on **Friday February 20, 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`.

1. Sipser, problem 3.12 (TM with left reset)

   In the solution, describe informally your simulation strategy and then, in more detail, show how, starting from an arbitrary Turing machine $M = (Q, \Sigma, \Gamma, \delta, q_0, q_{\text{accept}}, q_{\text{reject}})$, to define a new machine with left reset $M' = (Q', \Sigma, \Gamma', \delta', q'_0, q'_{\text{accept}}, q'_{\text{reject}})$ that recognizes the same language.

2. Sipser, problem 3.13 (TM with stay put instead of left)

   [Hint: show that the class of languages recognized by such machines is the class of regular languages.]

3. Sipser, problem 3.16 (decidable iff enumerable in lex order)

4. Say that string x is a *prefix* of string y if a string z exists where $xz = y$, and say that x is a *proper prefix* of y if in addition $x \neq y$. A language is *prefix-free* if it doesn't contain a proper prefix of any of its members. Let

   $$\mathsf{PrefixFree}_{\mathsf{REX}} = \{R | R \text{ is a regular expression where } L(R) \text{ is prefix-free}\}$$

   Show that $\mathsf{PrefixFree}_{\mathsf{REX}}$ is decidable.