Problem Set 1

This problem set is due on **Wednesday, September 9, by 5:00pm.**

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. Give an NFA that accepts the language of Java comments. Let $\Sigma = \{\texttt{/}, \texttt{*}, \texttt{x}\}$, where `x` stands in for any other character. The language contains strings that start with '`/*`', end with '`*/`' and do not contain another '`*/`' in the middle.

   For example, the following strings are in the language: '`/*xxx*/`', '`/**/`', '`/*****/`' and '`/*xx/*xx*/`'; the following strings are not in the language: '`xx`', '`xx/**/x`', and '`/*/`'.

2. Show that the following language is regular:

   $$L := \{ \text{ strings over } \{0,1\}^* \text{ containing 01001 as a substring } \}$$

3. Show that the following language is regular:

   $$L := \{ \ 0^i 1^j : i + j \text{ is even } \}$$

4. For each fixed positive integer k, define L_k to be the language $(0 \cup 1)^* \cdot 1 \cdot (0 \cup 1)^k$.

   Prove that, for every k, L_k is regular by constructing an NFA that accepts it. The number of states of the NFA should be linear in k. ($k + 3$ should be enough.)

   Describe a DFA for L_{10}. You should formally specify the states, the transition function, and the initial and final states. Prove that your DFA accepts L_{10}.