Problem Set 2

This problem set is due on **Thursday September 15th, 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. Let L be a language that contains only finitely many string. Show that L is regular.

2. Fix the alphabet $\Sigma = \{a, b\}$. Let L be the collection of all strings which contain the same number of copies of ab and baa. Here are a couple of examples: the string $baab$ is in L because it contains one copy of ab (ba**ab**) and one copy of baa (**baa**b); The string $abaab$ is is not in L because it contains two copies of ab (**ab**a**ab**) but only one copy of baa (a**baa**b).

   Show that L is regular.

3. Show that each of the following statements is true by analyzing the proof that a language is regular if and only if it has a regular expression.

   (a) If a language L is recognized by an NFA with k states, then L is described by a regular expression of length $O\left(4^k\right)$.

   (b) If a language L is described by a regular expression of length m, then there is an NFA which recognizes L and has at most $O\left(m\right)$ many states.