The first three problems are "routine" pumping lemma problems, where you prove that a given language is not regular by following a pretty standard procedure. Many students have difficulty with such problems at first, but then greatly improve with practice. If after doing these three problems you feel that you need more practice with routine problems, then do problems 1.46, 1.47, 1.49, 1.71b, etc. Also consult old exams, the prefect, me, etc.

A. Do problem 1.29b (about "www").

B. Do problem 1.35 (about "bottom is reverse of top").

C. Do problem 1.53 (about "ADD").

These last three problems are also about the pumping lemma, but they're not so standard.

D. Do problem 1.54 (about a non-regular language that can be pumped anyway).

E. (This is essentially problem 1.55h, but expanded into three subproblems.) Working over the alphabet $\Sigma = \{0, 1\}$, let A be the language matched by the regular expression `10(11*0)*0`.

1. Draw a DFA for this language. (Try to do this directly, without converting the regular expression to an NFA and the NFA to a DFA.)
2. Based on the proof of the pumping lemma and your DFA from part 1 of this problem, what pumping length do you expect for A? (This question is intended to help you understand the *proof* of the pumping lemma.)
3. What is the minimum pumping length for A, as defined by problem 1.55?

For any textbook regular expression (TRE), there exists an equivalent Python regular expression (PRE). The converse is not true: There exists a PRE such that, when you use it in the `matches` function from our Python regular expression tutorial, the strings that it matches do not constitute a regular language.

F. Working over the alphabet $\Sigma = \{0, 1\}$, find such a PRE. Your PRE should match no strings that contain any characters other than 0 and 1. Try to make your example small and simple. (Mine is seven characters.) Explain what language it matches. Prove that the language is not regular. Submit your answer on paper.

Want a hint? I'll type it backwards, so that you don't accidentally read it: .egaugnal ralucitrap siht deiduts ton evah ew tub ,raluger-non eb ot ssalc ni devorp evah ew taht segaugnal ot ralimis si fo gnikniht m'I egaugnal ehT .puorg a esU