ECS 120 Problem Set 5

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Problem 1 (a) Yes, this is a regular language.

Since the distinct number of decimal digits is finite, i.e. less than or equal to 10, we can construct an NFA to correspond to this. We need not know which digits appear infinitely often. We just need our NFA to have an arrow for each d in $\{0, 1, 2, ..., 9\}$ where d is a decimal digits that occurs infinitely often.

(b) No, this is not a regular language.

Assume for contradiction that L_b is regular.

Then, there exists some ρ such that, for all $s \in L_b, |s| \geq \rho$, there exists some $xyz = s, y \neq \varepsilon$ such that, for all $i \geq 0, xy^iz \in L_b$.

Now, this implies that there is some repeating pattern within the decimal representation of π. However, since π is irrational, there can be no such repeating pattern.

From this contraction, we see that L_b is not regular.