CSE 390z: Mathematics for Computation Workshop

QuickCheck: 9. Irregular Languages Solutions (due Tuesday, March 10)

Please submit a response to the following questions on Gradescope. We do not grade on accuracy, so please submit your best attempt. You may either typeset your responses or hand-write them. Note that hand-written solutions must be legible to be graded.

We have created **this template** if you choose to typeset with Latex. **This guide** has specific information about scanning and uploading pdf files to Gradescope.

0. Irregular Languages

Consider the language $L = \{0^a 1^b 2^c : a, b, c \geq 1, a \neq c\}$ over the alphabet $\Sigma = \{0, 1, 2\}$. Prove that L is irregular.

Solution:

Suppose for contradiction there exists some DFA M that recognizes L.

Consider the set $S = \{0^k 1 : k \geq 1\}$. Since S is infinite, and M has finitely many states, there must be two distinct strings, $0^m 1$ and $0^n 1$ for some $m \neq n$ that end at the same state in M.

Consider appending 2^n to both strings.

Note that $0^m 1 2^n \in L$ since $m \neq n$ and $0^n 1 2^n \notin L$, but they both end up in the same state of M, call it q. Since $0^m 1 2^n \in L$, state q must be an accept state, but then M would incorrectly accept $0^n 1 2^n \notin L$, so M does not recognize L.

Thus, no DFA recognizes L, and L is irregular.

Solution:

1. Video Solution

Watch **this** solution video **after** making an initial attempt. Then, answer the following questions.

(a) What is one thing you took away from the video solution?