

Review Session 1

1 Exam

The midterm will have the same duration of class, 80 minutes. Students can bring one page (one sided) of notes, and it's closed book otherwise. Given the time constraints, in a question of the form "prove that this language is regular" it would be enough to provide correct automaton or reg exp without an inductive proof of correctness. A proof that a language is not regular should be complete. On decidability, describing a machine in pseudocode is sufficient.

2 Skills

- Designing a regular expression or an automaton for a given regular language, and be able to translate from one model to the other.
- Prove non-regularity of a language, either by exhibiting infinitely many distinguishable strings or by applying the pumping lemma.
- Optimize a DFA.
- Understand at a reasonably low-level detail how different types of Turing machines can simulate each other or solve very basic problems.
- Prove decidability by expressing algorithms in pseudocode.

3 Practice Problems

1. Let L_a be the language containing all strings except a . Let C be the complement of a language L which is not regular. Then $\bigcap_{a \in C} L_a$ is L , and so not regular, but each L_a is regular.
2. The strings $1, 11, 111, \dots$ are all distinguishable.
3. The equivalence classes are $[\epsilon], [0], [1], [11]$, and $[110]$ and the minimal automaton has 5 states.
4. Consider the process of simulating an enumerator for the language, then every time it produces a string x lexicographically larger than all previously enumerated ones, output x . This process outputs a lexicographically ordered set of strings in the language, and it must output infinitely many strings, because otherwise there would be a time when a string x is output by the simulated enumerator, and then all strings after that are smaller than x , but this would imply that the enumerator outputs only finitely many different strings. The outputs of the above process are lexicographically sorted and infinitely many, so they are a decidable infinite subset of the original language.