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Note: No textbook or notes to be used during the exam.

Problem 1. Finite Automaton. [10 points] No explanation necessary.

Give a single finite automaton (DFA or NFA) that accepts the language consisting of all strings of the form $(0101)^*(1010)^*$ or $(1010)^*(0101)^*$.

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Problem 2. Not Regular. [10 points]

Prove that the set of strings $\{1^{n^2} \mid n \text{ is a positive integer}\}$ is not a regular language.

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Problem 3. Count Able. [10 points]

Prove that the set of finite python programs is countable.

Problem 4. True or False. [10 points] No explanation necessary.

Indicate whether each of the following is True (T) or False (F).

- ☐ Nondeterministic TMs are more powerful, i.e., can accept more languages, than Deterministic TMs.
- ☐ Nondeterministic Finite Automata are more powerful, i.e., can accept more languages, than Deterministic Finite Automata.
- ☐ For any set of strings L , there is a TM that can correctly determine whether a given string x belongs to L .
- ☐ Every TM with the binary input alphabet will eventually halt on the input string consisting of a single zero.
- ☐ The Pumping Lemma can be used to show that a language is not decidable.