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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 $L = \{x \mid x = (0101)^*(1010)^* \text{ or } x = (1010)^*(0101)^*\}$.

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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., accept more languages) than Deterministic TMs
- Nondeterministic Finite Automata are more powerful (i.e., 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 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.