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 following language L:
$$L = (0101)^*(1010)^* \cup (1010)^*(0101)^*$$

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.

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. |