Automata Theory - Scrimmage I

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1 Instructions

1. The Scrimmage will not be graded, i.e., there are no points.

2. Attempt as many problems as you can.

2 Problems

1. Prove using Mathematical Induction:

$$\sum_{i=1}^{n} i^3 = (\sum_{i=1}^{n} i)^2$$

2. Let $\Sigma = \{0, 1\}$. Draw a DFA for the language L containing strings having the pattern 010 in them.

3. Let $\Sigma = \{0, 1\}$. Draw a NFA for the language L consisting of strings in which the final digit has appeared before.

4. Repeat the above problem for strings in which the final digit has not appeared before.

5. Let $\Sigma = \{0, 1\}$. Let $L \subseteq \Sigma^*$ represent the language of those strings that do not contain the pattern 101. Argue that L is regular.

6. Argue that $(R^*)^* = R^*$, for any regular expression R.

7. Is $L = \{0^n 10^n | \ n \geq 1\}$ regular? Explain.

8. Let $\Sigma = \{0, 1, 2\}$ and $\tau = \{a, b\}$. Consider the homomorphism h defined by $h(0) = a$, $h(1) = ab$ and $h(2) = ba$. Let L be the unit string language $\{ababa\}$. What is $h^{-1}(L)$?