Automata and Computation Theory Homework 1 — Due by 7pm on Feb. 4

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Reading: Chapter 0 of the textbook.

1. (25 points) For any three sets A, B, C, prove that
$$(A \cap B) \cup C = (A \cup C) \cap (B \cup C).$$
2. (25 points) In the textbook it is shown that $\sqrt{2}$ is an irrational number. Use this fact to show that the following statement is true: there exist two irrational numbers p and q, such that q^p/p^2 is a rational number.
3. (25 points) Show that there exist no integers x, y, z such that $3x^2 + 3y^2 = z^2$, except $x = y = z = 0$.
4. (25 points) Let r be a number such that $r + 1/r$ is an integer. Use induction to show that for every positive integer n, $r^n + 1/r^n$ is an integer.