Computer Science 456/656 Spring 1999 First Examination, February 10, 1999

Name:_____

No books, notes, or scratch paper. Use pen or pencil, any color. Use the rest of this page and the backs of the pages for scratch paper. If you need more scratch paper, it will be provided.

The entire test is 65 points.

1. True or False. [5 points each]

   (a) _____ The language of all binary numerals for prime numbers is regular.

   (b) _____ The language of all binary numerals for powers of 2 is regular.

   (c) _____ Every subset of a regular language is regular.

   (d) _____ A language L is regular if and only if there is some NFA M which accepts L.

2. Fill in each blank with **one** word. [5 points each blank]

   (a) Every NFA with n states is equivalent to a unique _____ DFA, which has at most _____ states. (I want the formula.)

   (b) If M is a _____ machine, then, given any configuration x of M, there is at most one configuration y of M such that M can change from x to y in one step.

3. Draw a minimal DFA which accepts the language of all strings over $\{0, 1\}$ which contain no instance of 11 as a substring. [15 points]

4. Let L be the language consisting of all strings w over the alphabet $\Sigma = \{a, b\}$ such that $\#_a(w) = \#_b(w)$, that is, all strings with equal numbers of each symbol. Prove that L is not regular. [20 points]