Tutorial #3

Answer any five. (You can leave out one, but try that one offline as homework).

- 1. (2 points) Show that the following language is regular. The set of all strings $x \in \{0, 1\}^*$ for which the number of zeros in x is divisible by 3 but not by 4.
- 2. (2 points) Is the following language regular? If so, prove it:

 $A = \{x \in \{0,1\}^* : x \text{ is a binary representation of an even number.}\}\$

3. (2 points) Show that the following language is not regular:

$$L = \{a^i b^j c^k : i, j, k \ge 0 \land (i = 1 \implies j = k)\}$$

4. (2 points) Let A and B be two languages. Define the *perfect shuffle* of the languages as: $\{w: w = a_1b_1a_2b_2...a_kb_k \text{ where } a_1...a_k \in A \text{ and } b_1...b_k \in A \text{ for each } a_i, b_i \in \Sigma \}$

Show that the class of regular languages are closed under perfect shuffle.

5. (2 points) Design an optimal automaton (in terms of number of states) for the following language (fix a number m):

$$L = \{a^m\}$$

Why is your automaton optimal? What are the Myhill-Nerode equivalence classes?

6. (2 points) Minimize the following automaton. (Skipping the drawing)