IITM-CS2200 : Languages, Machines and Computation

## 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:

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

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

$$
L=\left\{a^{i} b^{j} c^{k}: i, j, k \geq 0 \wedge(i=1 \Longrightarrow j=k)\right\}
$$

4. (2 points) Let $A$ and $B$ be two languages. Define the perfect shuffle of the languages as:

$$
\left\{w: w=a_{1} b_{1} a_{2} b_{2} \ldots a_{k} b_{k} \text { where } a_{1} \ldots a_{k} \in A \text { and } b_{1} \ldots b_{k} \in A \text { for each } a_{i}, b_{i} \in \Sigma\right\}
$$

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 $m$ ):

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

Why is your automaton optimal? What are the Myhill-Nerode equivalence classes?
6. (2 points) Minimize the following automaton. (Skipping the drawing)

