Assignment 4

(Please work in groups of two or three and submit one answer sheet for the group.)

1. You have just finished building a 200-state FA masterpiece, when your boss pops in to say that the rules for the language have been changed. A new character $ has been added to the alphabet. This may replace any one character once in the original string. For example, if your masterpiece accepts MEET, the redesigned FA must accept both $EET$ and $MEST$ (and still MEET but not $MSSL$ ). Explain how to modify your FA.

2. Let $M$ be the language of all binary strings that contain the substring 11 and whose number of 0's is even. (For example, 0101100 is in $M$.)
   (a) Give a collection of strings such that your strings are pairwise distinguishable with respect to $M$ and your collection is as big as possible.
   (b) Give a collection of strings such that your strings are pairwise indistinguishable with respect to $M$ and your collection is as big as possible.
   Justify your answers.

3. Let $E$ be the language generated by the regular expression $\text{(00\text{*}(11\text{*})}$. Give a CFG for $E$.

4. For each of the following CFGs:
   (1) determine which of the strings $\varepsilon$, $abba$, $aaaaa$ and $b$ is generated, and
   (2) give an English description of the language.

   (a) $S \rightarrow aS \mid bS \mid a \mid b \mid \varepsilon$
   (b) $S \rightarrow XaaaX$
      $X \rightarrow aX \mid bX \mid \varepsilon$
   (c) $S \rightarrow aaS \mid aaaS \mid a$
   (d) $S \rightarrow aX \mid bS \mid a \mid b$
      $X \rightarrow aX \mid a$

Due: Wednesday September 27