Homework Assignment 6

Due: Tuesday, March 22, 2005, by 12 PM (IN CLASS)

Name: __________________________________________

Student ID (8 digits): ________________________________

Email: ___________________________________________

Signature: ________________________________________

PLEASE, READ THE FOLLOWING INSTRUCTIONS:

• Fill out this form with your name, student ID, email, and signature and return it as the cover page of your homework.

• Turn in your homework at the beginning of your class on the due date described at the top of this page.

• Late assignments will be penalized 25% and will not be accepted after 1:30PM of the day following the due date.

• Late assignments must be turned in to Janean Williams in room 308, 3rd floor, Levine Building.

• All writings must be neat, well-organized, and include sufficient explanations in the delineation of the solutions.

• Full credit will be given only in the case where the correct answer has been properly justified with complete explanations.

• Good luck!

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TOTAL: __________________________________________

Max: 25 25 25 25
Problem 1 [25 points]
Show that the language \( L \) such that

\[
L = \{ x \in \{a, b\}^* \mid x = ww, \text{ for some } w \in \{a, b\}^* \} = \{ \epsilon, aa, bbaa, abab, baba, bbbb, \ldots \}
\]

is not a regular language.
Problem 2 [25 points]
Show that the language $L$ such that

$$L = \{ w \in \{a\}^* \mid |w| = j^2, \text{ for some integer } j \} = \{ \epsilon, a, aa, aaaa, \ldots \}$$

is not a regular language.
Problem 3 [25 points]
Show that the language $L$ such that

$$L = \{ w \in \{a, b\}^* \mid |w|_a \geq |w|_b \} = \{ \epsilon, a, aab, aba, baa, \ldots \}$$

is not a regular language.
Problem 4 [25 points]

Let $D = (Q, \Sigma, \delta, q_0, F)$ be a deterministic finite automaton. Then, show that $L(D)$ is infinite if and only if there exists a string $w$ in $L(D)$ such that $|Q| \leq |w| < 2|Q|$, where $|w|$ is the length of $w$ and $|Q|$ is the number of states of $Q$. 