

CS341 Automata Theory

Summer 2007

Midterm

June 21, 2007

Name:

EID:

- Answer all questions. Please give **clear** and **rigorous** answers.
- Use extra paper to determine your solutions and then copy them neatly onto these sheets.
- Make sure you clearly write your name and EID on this page.
- There are 9 pages, including this one. Make sure you have all of them.

GOOD LUCK

<i>Question</i>	<i>Score</i>	<i>Maximum</i>
1a		12
1b		12
1c		12
2		12
3a		8
3b		8
4a		8
4b		8
5		10
6		10
Total		100

1. For each of the following languages, state whether the language is (I) regular, or (II) context-free but not regular. Prove your answer.

(a) $L = \{wa^n a^n w^R \mid w \in \{a, b\}^* \text{ and } n > 0\}$

$$(b) L = \{xyx^R \mid x \in \{a, b\}^+, y \in \{a, b\}^*\}$$

(c) $L = \{x\#y \mid x \in \{0,1\}^* \text{ and when } x \text{ and } y \text{ are considered as binary numbers, } x = 2y\}$ (example: $10\#1 \in L$ since $2 = 2(1)$, and $100\#0010 \in L$ since $4 = 2(2)$).

2. Is $L = \{0^m 1^n \mid m \neq 2n\}$ regular or non-regular? Prove your answer.

3. Consider the language $L = \{w \in \{a, b\}^* \mid |w| \geq 1 \text{ and the first, middle and last symbols in } w \text{ are the same}\}$

(a) Give the state diagram of a pushdown automaton that recognizes L. Do **not** use the conversion algorithm to convert your CFG in b) to a PDA.

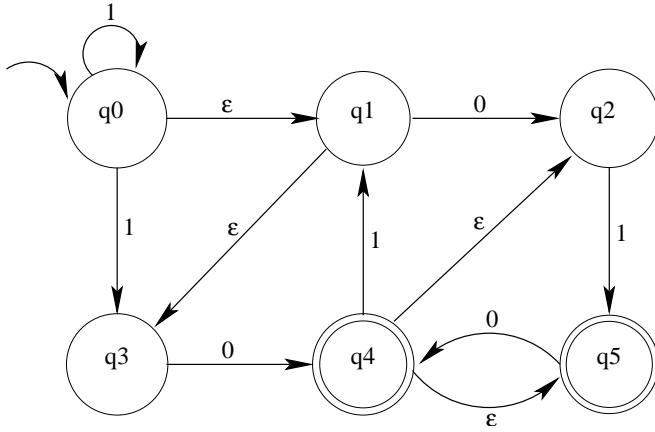
(b) Define a context-free grammar that generates L.

4. Consider the language $L = \{w \in \{a, b\}^* \mid \text{every } a \text{ in } w \text{ is followed immediately by the string } bb\}$

(a) Draw the state diagram of a deterministic finite automaton that recognizes L.

(b) Write a regular expression that describes L. Do not use the conversion algorithm to convert your FA in a) to a regular expression.

5. For the following NFA N , use the construction we discussed in class to produce an equivalent DFA D . Draw D 's state diagram. You must use the algorithm presented in class and show your work to receive credit.



6. Let L be a regular language over $\{0, 1\}$. Is it possible for the language $PLUS(L) = \{xx \mid x \in L\}$ to be non-regular? Prove your answer.