University of Technology
Computer Science Department
***Class:* Second Year**
***Time:* 3 Hours**

***Subject:* Computation Theory**
***Examiner:* Dr. Suhad M. Kadhem**

Final Exam / First Trail / 2009-2010

Note: answer **seven** questions only.

Q1. Find *regular expression* (RE) that defines the language of all words with at least one **a** and one **b**, and build *finite automata* (FA) that accepts the same language. (10 Marks)

Q2. Build a *Turing machine* (TM) that accepts the language: $\{a^n c^n b^n : n>=0\}$ (10 Marks)

Q3. Build a *Mealy machine* that can count how many times the substring **abba** occurs in a long input string, then convert it to *Moore machine.* (10 Marks)

Q4. Convert the following CFG into CNF:

$S \rightarrow aAb \mid bAa$

$A \rightarrow AabA \mid bAaA \mid \Lambda$ (10 Marks)

Q5. Build *pushdown automata* (PDA) for the language: $\{sa^n b^m$: s is any string of {a,b}, n>=1, m>=0 and length(s)=n }. (10 Marks)

Q6. Find CFG that accepts the language of all words with equal number of **a's** and **b's**, such as ababbaab. Can you find FA that accepts the same language, And why? (10 Marks)

Q7. If you have FA1 that accepts all words with even number of **a's**, and FA2 that accepts all words ending with **b**, build FA3 that accepts all words that have even number of a's **or** that end with b by using *Kleen's theorem.* (10 Marks)

Q8. If your input alphabet is {a,b}, build *finite automata* (FA) that accepts all words except **aba** and **a**, then find *regular grammar* (RG) that accepts the same language. (10 Marks)