EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

ECIAL DEGREE EXAMINATION IN COMPUTER SCIENCE 2013/2014 (Mar/Apr, 2016)

CSS 05: Theory of Computation

Answer all questions

This paper has 6 questions in a total of 2 pages

e allowed: **Three Hours**

inite *automata* are good models for computers with an extremely limited amount of memory.

a) State the formal definition of a finite automaton. [20%]

b) Create a finite automaton for strings made of "0" and "1" with a minimum length 3 and having every even character as "1". [30%]

c) Draw the state diagram for the finite automaton you have created in part (b). [10%]

d) Describe what is meant by *regular language*. [20%]

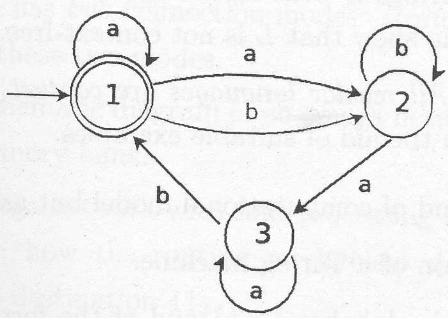
e) Differentiate *Deterministic Finite Automata* and *Non-deterministic Finite Automata*. [20%]

gular *expressions* are another means to define languages.

a) State the advantages of regular expressions over finite automaton. [10%]

b) Write a regular expression for the language with alphabet "0" & "1" and contains an even number of "0"s and each "0" is followed by at least one "1". [25%]

c) Convert the finite automaton given in the following figure into regular expression. [25%]



) State the *Pumping lemma* for regular languages and its purpose. [20%]

) Let L be a language with alphabet $\{a, b\}$ and of the form $\{a^n b^{2n} : n \geq 0\}$. Prove by applying the pumping lemma that L is not regular. [20%]

ntext-free grammars are traditionally used for defining the syntax of programming languages d their compilation.

) State the definition of a context free grammar. [25%]

) Let L be a language of strings w with alphabet $\{a, b\}$ satisfying the following:

- there are no empty strings
- the number of "a"s in w is equal to the number of "b"s in w
- w does not contain the substrings "$abba$" and "$bbaa$"

[Question 3 continues on the next page]

i. Write five different valid strings of the above language.

ii. Create a context free grammar for the language L defined above. Note: I should be able produce as many different patterns of strings as possibl possible valid strings.

iii. Create a parse tree for a string with at least eight alphabets. Note: C such that it needs many grammar rules for parsing.

4. *Pushdown automaton* is another kind of computational model similar like *finite c*

   (a) Give the definition of a *deterministic pushdown automaton.*

   (b) Write the format of the *transition function* of the pushdown automaton clearly.

   (c) Let L be a language of strings w with alphabet $\{a, b\}$ and of the form $\{$ Create a pushdown automaton for the language L.

   (d) Apply the pushdown automation developed in part (c) to show that the st valid string of the language L defined in part (c).

5. Pumping lemma for regular languages can be generalised for *context-free langua*

   (a) Write the Pumping lemma for the context-free Languages.

   (b) Let L be a language of strings w with alphabet $\{a, b\}$ and of the form $\{a$ Using the pumping lemma show that L is not context-free.

   (c) Explain the statement "*All regular languages are context-free but not all guages are regular*", with the aid of suitable examples.

6. *Turing machine* is another kind of computational model but as powerful as a r

   (a) Write the formal definition of a Turing machine.

   (b) Let L be a language with alphabet $\{a, b\}$ and of the form $\{a^n b^{2n} : n \geq$ Turing machine with one tape that can accept strings of the language L.

   (c) Show how the Turing machine constructed in part (b) works to accept the

End