THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. DEGREE PROGRAMME: LEVEL 05
FINAL EXAMINATION – 2017/2018
DEPARTMENT OF COMPUTER SCIENCE
CSU5305/CPU3144 – THEORY OF COMPUTING
DURATION: Two Hours only

Date: 30th March 2019 **Time: 1.30pm – 3.30pm**

Answer Four Questions Only.

1.

i. What is meant by grammar?
ii. How could a grammar be a **"Regular Grammar"**?
iii. Give the definition of Regular Expressions over an alphabet $\sum$.
iv. What is the connection between regular expressions and regular languages?
v. Write a regular expression for each of the languages given below.
   a) For set of all strings, containing exactly one **"a"** over $\sum = \{a, b, c\}$.
   b) For set of all strings over $\{0, 1\}$ beginning with 00.

2.

i. How many types of grammar are in Chomsky Hierarchy of grammars?
ii. Write the names of the types in the ascending order.
iii. Draw a graphical representation of the types you mentioned in your answer to part (ii).
iv. Given a grammar Q <{S},{a ,b},P,S> ,
where P is

$S \longrightarrow aSb$
$S \longrightarrow \varepsilon$

Derive the string **aaabbb** using the above grammar.

3.

i. How many essential features are there in a computing device? Name these features.
ii. What is meant by the term "**abstract**" in the abstract machine in the field of theoretical computer science?
iii. Explain the operation of an "**automatic door**" using a transition table.
iv. Draw a transition graph for automatic door in part (iii).

4.

i. Define the following terms.
   a) Alphabet
   b) String
   c) Empty string
   d) Length of a string

ii. Give three names of operations on "**strings**" and write an example for each of the operations you named.

iii. Give three names of operations on "**languages**" and write an example for each of the operations you named.

iv. If R_1 and R_2 are relations, write the following in set notation.
   a) Union of R_1 and R_2
   b) Intersection of R_1 and R_2
   c) Composition of R_1 and R_2

5.

i. What is a derivation tree in the context of Theory of Computation?

ii. Write the names of two types of derivation trees.

iii. Construct the derivation tree for the string a+ (a*a) with the grammar rules given below.

$S \longrightarrow S+S$

$S \longrightarrow S*S$

$S \longrightarrow (S)$

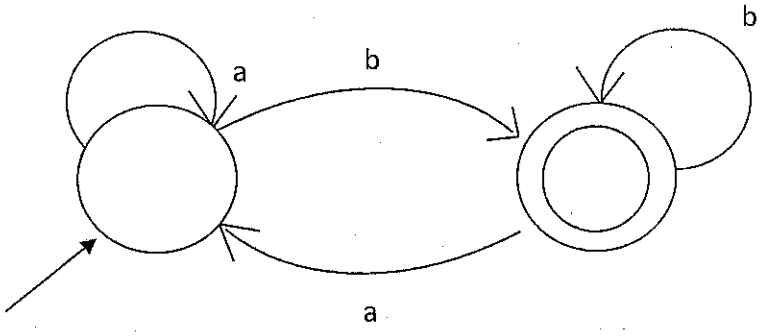
$S \longrightarrow a$

iv. Name the type of the derivation tree that you used when answering of part (iii).

6.

i. What is meant by Finite State Automation?

ii. Consider the following Finite Automation



What are the strings accepted by the automation ?

iii. What is the difference between **Deterministic Finite Automation (DFA)** and **Non Deterministic Finite Automation (NDFA)?**

iv. Draw DFA's for accepting each of the following languages.

a) A set of strings over $\sum = \{0, 1\}$ having an odd number of 1's .

b) A set of all strings over $\sum = \{a, b, c\}$ containing **aab** as a substring.

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