The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. Degree Programme - Level 05
Department of Computer Science
CSU5305 – Theory of Computing
Final Examination (2nd Semester) 2024/2025
Duration: Two Hours Only

Date: 24.05.2025 Time: 1.30p.m.-3.30 p.m.

ANSWER FOUR (04) QUESTIONS ONLY.

Q1.

a) Give the definitions of an alphabet, a string and a language with regard to Theory of Computing.

b) What is the main difference between a string and a word of a language?

c) Indicate whether the followings are valid or invalid alphabets. **(You are not required to give any justifications for your answers)**
   i. $\sum$= {a.b}
   ii. $\sum$= {a.b.cd}
   iii. $\sum$= {a.b.ae}

d) Name three operations common to both strings and languages.

[25 Marks]

Q2.

a) What is meant by **Derivation** with regards to Theory of Computing?

b) Derive the string **abb** using Left most derivation with only the rules of CFG are given below.

$S \longrightarrow AB \cdot \varepsilon$
$A \longrightarrow aB$
$B \longrightarrow Sb$

c) Using the production rules

$E \longrightarrow E+E$
$E \longrightarrow E*E$
$E \longrightarrow a \mid b \mid c$

Draw a derivation tree for the string **a*b+c**

d) What do you mean by the statement **"A grammar Q is ambiguous?" (Do not use any examples for the explanation)**

[25 Marks]

Q3.

a) What is a **transition system** in Theory of Computing?

b) Explain briefly how a State Transition System (STS) works.

c) Give three examples where the concept of STS is used in daily life.

d) The transition table given below shows a Deterministic Finite Automata (DFA).

Present State	Next State for input 0	Next state for input 1
→ q_0 (initial)	q_0	q_1
q_1	q_2	q_1
q_2 (final)	q_0	q_1

Draw the equivalent transition graph.

[25 Marks]

Q4.

a) What is represented by Chomsky Hierarchy of Grammars?

b) What are the four classification of grammars by Chomsky? Give the type and the relevant name.

c) Give the names of the machines that are accepted by the above four grammars.

d) To the answer given for Q4 part (b), draw a diagram to depict the relationship.

[25 Marks]

Q5.

a) In Theory of Computing define a **Regular Expression**.

b) Where can you use regular expressions as symbolic notations?

c) Provide three names of tasks, where regular languages are commonly used.

d)

i. What is the relationship between a Regular grammar and a Regular language?

ii. In order to have the above relationship what conditions are to be satisfied?

[25 Marks]

Q6.

a) Give the definition of **Finite Automata (FA).**

b) What are the components of a Finite Automaton model? Explain the model briefly.

c) Provide three applications of Automata Theory.

d) Write any three differences between Finite Automata (FA) and Push Down Automata (PDA).

[25 Marks]