

**The Open University of Sri Lanka**  
**Faculty of Natural Sciences**  
**B.Sc/ B. Ed Degree Programme**



<b>Department</b>	<b>: Computer Science</b>
<b>Level</b>	<b>: 05</b>
<b>Name of the Examination</b>	<b>: Final Examination (2<sup>nd</sup> Semester)</b>
<b>Course Title and - Code</b>	<b>: CSU 5305 - Theory of Computing</b>
<b>Academic Year</b>	<b>: 2020/2021</b>
<b>Date</b>	<b>: 04.04.2022</b>
<b>Time</b>	<b>: 9.30 am -11.30 am</b>
<b>Duration</b>	<b>: Two hours only</b>

**General Instructions**

1. Read all instructions carefully before answering the questions.
  2. This question paper consists of **(06)** questions in **(03)** pages.
  3. Answer any **(04)** questions only. All questions carry equal marks.
  4. Answer for each question should commence from a new page.
  5. Draw fully labelled diagrams where necessary
  6. Involvement in any activity that is considered as an exam offense will lead to punishment
  7. Use blue or black ink to answer the questions.
  8. Clearly state your index number in your answer script
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**Answer Four Questions Only**

(01)

- i. What do you mean by “**derivations**” regarding grammars?
- ii. How many types of derivations you have studied under the course CSU 5305 – Theory of computing?
- iii. Write the names of the types of derivations.
- iv. (a) What is the name given for the geometrical representation of a derivation?  
(b) Suppose  $G_1 = \langle \{S\}, \{a, b\}, P, S \rangle$  where ,

$$S \rightarrow aSb$$

$$S \rightarrow \epsilon$$

Derive the sentence **aaabbb**.

**(25 marks)**

(02)

- i. Write the two types of Finite Automation.
- ii. What is the main difference between the two types?
- iii. Write the conditions for a regular expression, over an alphabet  $\Sigma$ .
- iv. Define *Kleene Closure* and *Positive Closure* regarding languages.

**(25 marks)**

(03)

- i. Explain the following terms regarding grammars.
  - (a) Terminal symbols
  - (b) Non Terminal symbols
  - (c) Grammar rules
- ii. Write the names of the grammar under Chomsky Hierarchy of grammars.
- iii. The grammar  $\langle N, \Sigma, P, S \rangle$  which has the production rules of the form  $A \rightarrow \alpha$  where A is any single non terminal and  $\alpha$  is any combination of terminals and non terminals. According to your answer to 3 (ii) give the name of the grammar and justify your answer.

iv. Let Q be the grammar given by the production rules,

$$S \rightarrow aSa$$

$$S \rightarrow aBa$$

$$B \rightarrow bB$$

$$B \rightarrow b$$

Then if L(G) is given by  $L(G) = \{a^n b^m a^n : n > 0, m > 0\}$  What can you decide about the strings of the language L ?

(25 marks)

(04)

- i. What are the components of Pushdown Automata (PDA) ?
- ii. What is meant by a Turing machine (TM)?
- iii. What is the special feature of TM?
- iv. Give the main reason, for a TM is more powerful than a Finite State Machine (FSM) ?

(25 marks)

(05)

- i. What is a transition system regarding to Theory of Computing?
- ii. Give the definition of the State Transition System (STS).
- iii. There are many ways of representing transition systems. Write only three ways that a transition system can be represented.
- iv. (a) How many essential features are there in any computing device?  
(b) Give the names of the essential features.

(25 marks)

(06)

- i. When we define a string or a word what is the most essential condition that should be stated?
- ii. What is a length of a **string**? Explain with any example you like.
- iii. A regular expression denoting a language over  $\Sigma = \{1\}$ .

- (a) Write a string with an even length.
- (b) Write a string with an odd length.
- iv. If S and T are sets of strings. Write the concatenation of the two sets of strings in set notation.
- v. (a) If L and M are two languages over an alphabet write the union of the two languages in set notation.
- (b) Given that  $L = \{001, 10, 111\}$  and  $M = \{\epsilon, 001\}$  over  $\langle 0, 1 \rangle$ , What is the union of L, M ?

**(25 marks)**

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