00214

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

Department	: Computer Science
Level	: 05
Name of the Examination	: Final Examination (2nd Semester)
Course Title and - Code	: CSU 5305/ CPU 3144 Theory of Computing
Academic Year	: 2019/2020
Date	: 24.02.2021
Time	: 9.30 am -11.30 am
Duration	: Two hours only

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

(1) (i) (a) What is the difference between the strings and the words of a language?

(b) Define any alphabet you prefer and write two strings and two words.

(ii) Are an alphabet and an element of a set the same? Justify your answer.

(iii) What is the difference between language of **empty string** and **empty set language**?

(iv) What is the concept between **Valid** and **Invalid** alphabets? State whether the alphabets given below are Valid/ Invalid.

(a) $\sum$ ={a,b} (b) $\sum$={a,b,cd} (c) $\sum$={a,b,ac}

(25 marks)

(2) (i)(a) Explain how a **regular expression** is mapped to a **regular language**?

(b) Find a regular expression corresponding to the language of all strings over the alphabet ($\sum$ ={a,b}) in which the total number of a's is divisible by three.

(ii) What is the language represented by each of regular expression given below?

(a) (0+1) (b) (0+1)* (c) $(0+1)^+$ (d) (01)*

(iii) Differentiate between the Deterministic Finite Automation (DFA) and Non Deterministic Finite Automation (NDFA).

(iv) Draw a DFA that recognizes the language over alphabet {0,1} consisting of all those strings that contain an odd number of 1's. **(25marks)**

(3) (i) What are three ways to simplify a Context Free Grammar (CFG)?

(ii) How many type properties are there under a Context Free Languages (CFL) generated by a CFG? Name the properties.

(iii) Write the Context Free Languages generated by the grammar G (N,∑,P,S) , where

N is an alphabet whose elements are called Nonterminal symbols.

∑ is an alphabet disjoint from N, whose elements are called terminal elements.

P is called production rules,

S is a symbol in N called the start symbol,

For the following grammar rules.

(a) P ={S→aSb , S→ab}

(b) P={ S→aSb/aAb , A→bAa , A→ba }

(iv) For the languages you generated for the above part ((3)iii)) write down a string of CFL as a general formula for (a) and (b) separately.

(25 marks)

(4) (i) Give the names of grammar types you have studied under the course "Theory of Computing".

(ii) Write a single name to the above mentioned grammar types.

(iii) Represent the grammar types you have given as answer to (4(ii)) graphically.

(iv) What is derivation in the context of grammars? Using an example explain what " Leftmost" and "Rightmost" derivations are?

(25 marks)

(5) (i) What is meant by "Ambiguous Grammar" ?

(ii) Given that the grammar P={ S→aS|aSbS| Є} is ambiguous, construct the string **aab** under the three cases given below.

(a) Two parse trees

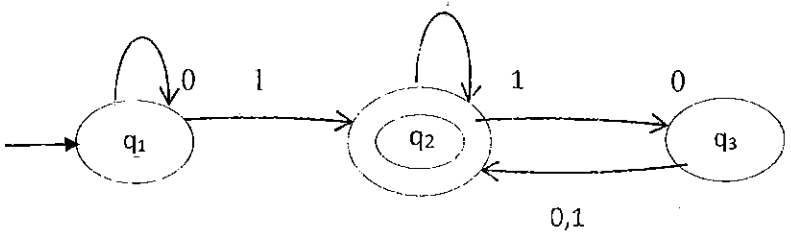
(b) One leftmost derivation

(c) One rightmost derivation

(iii) What is the main difference between a State Transition System (STS) and a Labeled Transition System (LTS)?

(iv) What are the three ways that a transition system can be represented?

(v) Suppose there is a machine with two inputs and three states and has some transition rules among the states according to the transition diagram given below.



(a) Is the automation finite?

(b) Give the names of the states.

(c) What are the inputs?

(d) Write the name of the initial state and the final state.

(25 marks)

(6) (i) Give the definition of "**Finite Automata**".

(ii) What are the components of a Finite Automation model? Explain the model briefly.

(iii) Provide three applications of Automata Theory.

(iv) Write three differences between Finite Automata and Push Down Automata (PDA).

(v) Explain the operation of an "Automatic Door" using a transition graph.

(25 marks)

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