



NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral one, Nnamdi Azikiwe Expressway, Jabi, Abuja
Faculty of Science
Computer Science Department
2024 1 EXAMINATION

PROGRAMME: B.Sc.
COURSE TITLE: FORMAL LANGUAGES AND AUTOMATA THEORY
COURSE CODE: CIT342
CREDIT UNIT: 3
DURATION: 2½ HRS

Instructions: Answer Question ONE (1) and any other three questions

- 1(a) Determine the Set of String in the Following sets
- i) $\{0, 1\}^* \{a, b, c, d\}$
 - ii) $\{a, ba, \}^* \{0, 1\}$
 - iii) $\{0, 1\}^* \{a, b\}$ (9 marks)
- (b) State the variations in the Transition Function and Acceptance Condition that exist in components of automata (10 marks)
- (c) Give regular expressions that generate each of the following languages. In all cases, the alphabet is $\Sigma = \{a, b\}$
- i) The language $\{w \in \Sigma^* \mid |w| \text{ is odd}\}$.
 - ii) The language $\{w \in \Sigma^* \mid w \text{ has an odd number of } a\text{'s}\}$.
 - iii) The language $\{w \mid w \text{ contains at least two } a\text{'s, or exactly two } b\text{'s}\}$.
 - iv) The language $\{w \in \Sigma^* \mid w \text{ ends in a double letter}\}$. (A string contains a double letter if it contains aa or bb as a substring.)
 - v) The language $\{w \in \Sigma^* \mid w \text{ does not end in a double letter}\}$.
 - vi) The language $\{w \in \Sigma^* \mid w \text{ contains exactly one double letter}\}$. (6 Marks)
- 2(a) State at least three Steps and the corresponding Method to Construct a right-linear grammar for any given left-linear grammar (9 marks)
- b) Discuss the definition concept of FSA (6 marks)
- 3(a) Defined the Closure Properties of Regular Languages (5 marks)
- (b) Distinguish between right-linear grammar and left-linear grammar (10 marks)
- 4(a) Using the pumping lemma Show that the language $L = \{a^i b c^i \mid i \geq 1\}$ is not context free. (10 marks)
- b) State two ways to use a grammar (5 marks)

- 5(a). Describe the algorithm to prove the finiteness of a regular language L. **(6marks)**
- b) Explain the term Finite in respect to automaton and with the aid of a diagram, show the following (i) transition state, ii) start state iii) Final State.**(9 marks)**
- 6 a) When is a grammar said to be ambiguous and in what state is language is said to be recursively enumerable **(9 marks)**
- b) State the Types of PDAs **(6 marks)**

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