Final Assessment Test – July 2023

VIT® Vellore Institute of Technology

Course: **BITE306L - Theory of Computation**

Class NBR(s): **0139 / 0141 / 0142 / 0144 / 0150** Slot: **A1+TA1+TAA1**

Time: **Three Hours** Max. Marks: **100**

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

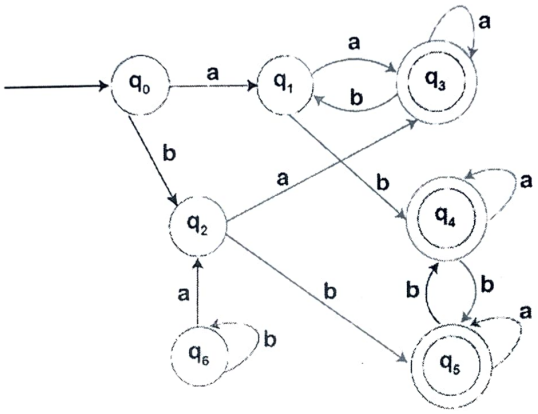
Answer ALL Questions

(10 X 10 = 100 Marks)

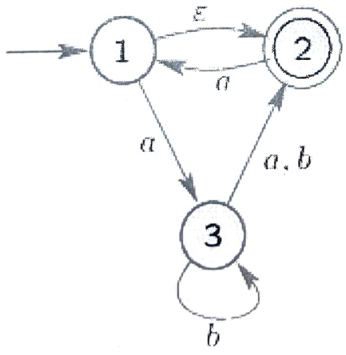
1. a) Construct a deterministic finite automaton for the language accepting strings containing neither '00' nor '11' as substring over input alphabets ∑ = {0, 1}. **[5]**

   b) Construct a non-deterministic finite automaton for the language of strings of length at least two whose last two symbols are the same. **[5]**

2. Construct the minimized DFA for the following DFA.



3. Construct the equivalent DFA for the following NFA.



4. Design a Moore machine for a binary input sequences such that if it has a substring 101, the machine outputs A; if the input has a substring 110, it outputs B; otherwise, it outputs C.

5. Determine the regular expression that generates the following language where the alphabet is Σ = {a, b}.

The language { w ∈ Σ* | w contains exactly one double letter }. For example, baaba has exactly one double letter, but baabba has two double letters.

6. Convert the following CFG into an equivalent CFG in Chomsky's Normal Form (CNF).

S → BSB | B | ε

B → 00 | ε

7. Construct the pushdown automata (PDA), which accepts the language $L = \{a^m\, b^n\, c^o\, d^p \mid \mathrm{m} = \mathrm{o} \text{ or } \mathrm{n} = \mathrm{p}\}$. Give all the specifications of the PDA and the instantaneous description for any one of the strings accepted by the language.

8. When a language is said to be recursively enumerable language and how it differs from recursive language? With suitable examples, explain in detail.

9. Explain briefly about the different types of Turing Machine (TM) and discuss the design of a Turing Machine(TM) that accepts the language, $L = \{a^n\, b^n\, c^n \mid \mathrm{n} \geq 0\}$. Also, write about its applications.

10. Explain the Halting Problem and the Post-Correspondence Problem. Discuss the above problems with suitable scenarios.

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