

Roll No.

Total No. of Questions : 09

Total No. of Pages : 03

Master of Computer Application (Sem.-3)

THEORY OF COMPUTATION

Subject Code : PGCA1927

M.Code : 90800

Date of Examination: 13-12-2023

Time : 3 Hrs.

Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying TEN marks each.
4. Select atleast TWO questions from SECTION - B & C.

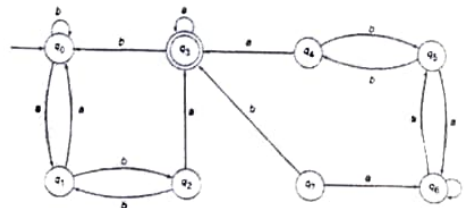
SECTION-A

I. Attempt the following :

- a) Briefly Discuss Russell's Paradox in the context of theory of computation.
- b) Draw a FA accepting the language L over {a, b} where L = "The language of all strings in which the number of a's is even."
- c) Give the mathematical definition of Mealy Machine.
- d) What are the closure properties of regular languages?
- e) How can we determine that a given grammar is ambiguous?
- f) Are Deterministic PDA (DPDA) and Non-deterministic PDA (NDPA) equivalent? Give an examples.
- g) Give an example of language which is accepted by Turing machine but not by linear bounded automata.
- h) Show that if L1 and L2 are recursive languages, then $L1 \cap L2$ is also recursive.
- i) Does the PCP with two lists $x = (b, bab^3, ba)$ and $y = (b^3, ba, a)$ have a solution?
- j) What are P and NP class of problems? Give examples of each type.

SECTION-B

2. Prove that Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA) are equivalent.
3. Minimize the following Automata:



4. a) Using Pumping Lemma, show that $L = \{a^n | n \text{ is a prime}\}$ is not regular.
- b) Find a regular expression corresponding to each of the following subsets of {a, b}.
 - i) The set of all strings containing exactly 2a's.
 - ii) The set of all strings containing at least 2a's.
 - iii) The set of all strings containing at most 2a's.
 - iv) The set of all strings containing the substring aa.
5. Convert the grammar $S \rightarrow AB, A \rightarrow BS | b, B \rightarrow SA | a$ into GNF.

SECTION-B

6. Construct a Pushdown automata which accepts all palindromes over {a, b}.
7. Design a Turing Machine that accepts $L = \{1^n 2^n 3^n | n \geq 1\}$
8. Show that the Halting Problem of Turing Machine is undecidable.

9. a) State the Church Turing Thesis. What is the importance of this Thesis in the context of Theory of Computation?
- b) Give at least five examples of problems which are intractable.

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Total No. of Pages : 02

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MCA (Sem.-3)

THEORY OF COMPUTATION

Subject Code : PGCA 1927

M.Code : 90800

Date of Examination : 18-06-2024

Time : 3 Hrs.

Max. Marks : 70

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SECTION-A

- I. Write short notes on :**

- a) DFA
- b) Moore
- c) Ambiguity
- d) Type-2 grammar
- e) CNF
- f) Left context
- g) Language
- h) Unit Productions
- i) PDA
- j) Transition Diagram.

SECTION-B

2. Construct a Moore machine equivalent to the Mealy machine M defined as follows:

Present State	Next State			
	a = 0		a = 1	
	state	output	state	output
→q ₁	q ₁	1	q ₂	0
q ₂	q ₄	1	q ₄	1
q ₃	q ₂	1	q ₃	1
q ₄	q ₃	0	q ₁	1

3. Write a note on how to minimize finite automata.
4. Define regular sets and write its closure properties.
5. Find a grammar in GNF equivalent to the grammar

$$E \rightarrow E + T \mid \quad T \rightarrow T * F \mid F \quad F \rightarrow (E) \mid a.$$

SECTION-C

6. Describe TM and its representations in detail.
7. Design PDA for $\{a^m b^m \mid m \geq 1\}$.
8. Explain in detail the Chomsky classification of languages.
9. Write a note unsolvable problem for context-free languages and classifying complexity.

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MCA (Sem.-3)
THEORY OF COMPUTATION

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SECTION-A

I. Write short notes on:

- a) Mealy machines
- b) Yield of a tree
- c) Left context
- d) Transition Diagram
- e) NDFA
- f) Type-3 grammar
- g) Right Derivative
- h) Theory of Computation
- i) LBA
- j) Normal Forms.

SECTION-B

2. Construct a finite automata equivalent to the regular expression:

$$(0+1)^*(00+11)(0+1)^*$$

3. Prove that $P + PQ^*Q = a^*bQ^*$ where $P = b + aa^*b$ and Q is any regular expression.

4. Find a grammar in GNF equivalent to the grammar

$$S \rightarrow XB \mid AA \quad A \rightarrow a \mid SB \quad B \rightarrow b \quad X \rightarrow a$$

5. What is a Derivation Tree and Grammar? Explain the concept of ambiguous grammar with help of example.

SECTION-C

6. Explain the variants of Turing Machines.
7. Design PDA for $\{wcw^T \mid w \in \{a,b\}^*\}$.
8. Write a note on halting problems and tractable and intractable problems.
9. Design Turing Machine of $\{0^n1^2n \mid n \geq 1\}$.

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