



End Term (Odd) Semester Examination December 2024

Roll no.....

Name of the Course and semester: MCA III

Name of the Paper: Theory of Computation and Compiler Construction

Paper Code: TMC 304

Time: 3 hour

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1.

(2X10=20 Marks)(CO1)

- a. Design an NFA for the language $L = \{w \in \{0,1\}^* \mid wL = \{w \in \{0,1\}^* \mid wL = \{w \in \{0,1\}^* \mid w \text{ ends with "101"}\} \}$. Convert the NFA to an equivalent DFA using the subset construction method and illustrate all states.

- b. Consider the DFA given by the following state table:

States | 0 | 1

A	B	C
B	A	D
C	D	E
D	C	F
E	E	E
F	F	F

Minimize the DFA and draw the minimized state diagram. Show each step of the process, including the partitioning of states.

- c) Design a Mealy machine that detects the input sequence "110" in a stream of binary inputs and outputs 1 at the end of the sequence (and 0 otherwise). Draw the state transition diagram and provide a state transition table to explain its behavior.

Q2.

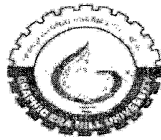
(2X10=20 Marks)(CO2)

- a. Convert the regular expression $ab^* + ba^*$ to a Deterministic Finite Automaton (DFA). Show all steps, including the intermediate NFA.
- b. Construct a regular expression for the language containing all strings over $\{0,1\}$ that contain an even number of 0s. Describe how regular expressions are used in lexical analysis in compilers. Provide examples to show how tokens are matched using regular expressions.
- c. What is a regular expression? Provide an example to represent a language of all strings containing the substring "101". Write the regular expression for all strings over the alphabet $\{a,b\}$ that begin and end with 'a'.

Q3.

(2X10=20 Marks)(CO3)

- a. Design a CFG that generates palindromes over the alphabet $\{a,b\}$. Demonstrate how the grammar



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works by deriving the strings "aba" and "abba".

b. Show that the following grammar is ambiguous:

$$E \rightarrow E + E \mid E * E \mid id$$

Provide two different parse trees for the string "id + id * id".

c. Define Context-Free Grammar (CFG). Differentiate between leftmost derivation and rightmost derivation with examples.

Q4.

(2X10=20 Marks)(CO4)

a. Describe the phases of a compiler with a neat diagram and explain the function of each phase with an example.

b. Describe the role of a lexical analyzer. Explain how a deterministic finite automaton (DFA) is used for token recognition.

c. Explain input buffering in detail.

Q5.

(2X10=20 Marks) (CO5)

a. Consider the following grammar:

$$S \rightarrow AB$$

$$A \rightarrow aA \mid \epsilon$$

$$B \rightarrow bB \mid \epsilon$$

Construct a parse table and demonstrate the working of a predictive parser for the string "aab".

b. Explain the working of an LR parser with a detailed example using the grammar:

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid id$$

Show the parsing table and parse the string "id + id * id".

c. List and briefly describe any four types of parsing techniques.