Graphic Era

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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∈{0,1}*|wL = \{w \in \{0, 1\}^* | wL={w∈{0,1}*|w 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}\{a, b\}{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

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:

$S \rightarrow AB$

$A \rightarrow aA \mid \varepsilon$

$B \rightarrow bB \mid \varepsilon$

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.