CBCS SCHEME

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21CS51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Automata Theory and Compiler Design

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

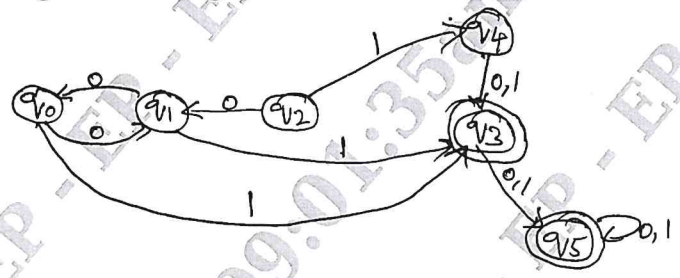
1 a. Define the three basic concepts of Automata. Also construct a DFA that accepts all strings that have the first and last letter different on Σ = {a, b}. Justify the DFA with example. **(10 Marks)**

b. Solve by converting the following NFA to DFA. **(10 Marks)**

OR

2 a. Explain the different phases of a compiler with neat block diagram and convert the source code. Position = Initial + rate * 60 into target code. **(10 Marks)**

b. Solve by Minimizing the following DFA. **(10 Marks)**



Module-2

3 a. Define the formal definition of Regular expression. Also write the regular expression for the following : i) Set of strings consisting of Even numbers of 'a' s followed by odd number of 'b's on Σ = {a, b}.
ii) $L = \{a^n b^m : (n + m) \text{ is even}\}$.
iii) $L = \{a^n b^m : n \geq 4 , m <= 3\}$. Justify the answer. **(10 Marks)**

b. Explain Input buffering in Lexical Analyzer. Define Token , Patterns and Lexemes with examples. Also write the tokens for E = m * c * * 2. **(10 Marks)**

OR

4 a. Define Regular Definitions. Write the Regular Definitions for 'C' identifiers and unsigned numbers using short hands notations and write the transition diagram. **(10 Marks)**

b. State and prove pumping lemma theorem for Regular languages. **(10 Marks)**

Module-3

5 a. Define Context free grammar. Write a CFG for the following :
i) To generate strings of palindrome over Σ = {0, 1}.
ii) $L = \{a^i b^j \mid i \neq j , i \geq 0 \text{ and } j \geq 0\}$
iii) $L = \{0^m 1^m 2^n \mid m \geq 1 \text{ ξ } n \geq 0\}$. Justify the answer. **(10 Marks)**

b. Define Left recursion and left factoring. Also remove the left recursion and left factoring for the Grammar

$E \rightarrow E + T \mid T$

$T \rightarrow id \mid id\,[\ ] \mid id\,[X]$

$X \rightarrow E, E \mid E.$ **(10 Marks)**

OR

6 a. Define Ambiguous grammar. Show that the following in ambiguous. **(10 Marks)**

$S \rightarrow iCtS \mid iCtSeS \mid a$

$C \rightarrow b$ for the string ibtibtaea

b. Consider the grammar

$E \rightarrow T E'$

$E' \rightarrow + T E' \mid \epsilon$

$T \rightarrow F T'$

$T' \rightarrow * F T' \mid \epsilon$

$F \rightarrow (E) \mid id$

i) Compute FIRST and Follow sets.

ii) Using FIRST and Follow sets construct the Predictive LL (1) parsing table. **(10 Marks)**

Module-4

7 a. Define Non Deterministic Pushdown Automata. Construct an NPDA for the Language $L = \{W \in (a, b)^* : n_a(w) = n_b(w)\}$ and draw the transition diagram. **(10 Marks)**

b. Define Handle and Handle Pruning. For the following grammar perform shift reduce for the string $id_1 + id_2 * id_3$.

$E \rightarrow E + E$

$E \rightarrow E * E$

$E \rightarrow (E)$

$E \rightarrow id.$ **(10 Marks)**

OR

8 a. Define Instantaneous Description in Pushow down Automata. Construct an NPDA for the Language $L = \{WCW^R : W \in (a, b)^*\}$. **(10 Marks)**

b. Consider the Grammar.

$S \rightarrow L = R \mid R$

$L \rightarrow * R \mid id$

$R \rightarrow L$

Verify the grammar is SLR (1) or not through the suitable parsing table. **(10 Marks)**

Module-5

9 a. Define Turing Machine. Construct a Turing Machine to recognize the Language.

$L = \{a^n b^n : W \in \{a, b\}^*\ n \geq 1\}$. **(10 Marks)**

b. Write the SDD for the grammar. Also construct the Annotated Parse tree for 5 * 6 + 7 ;

$S \rightarrow EN$

$E \rightarrow E + T$

$E \rightarrow E - T$

$E \rightarrow T$

$T \rightarrow T * F$

$T \rightarrow T / F$

$T \rightarrow F$

$F \rightarrow (E)$

$F \rightarrow digit$

$N \rightarrow ;$ **(10 Marks)**

OR

10 a. Construct a Turing Machine to recognize the Language.
$L = \{0^n 1^n 2^n \mid n \geq 1\}$ and trace the string 0 0 1 1 2 2. **(12 Marks)**

b. For the Grammar construct the SDD and the annotated parse tree for the string 3 * 5 * 4 and show the Evaluation order.

$T \rightarrow FT'$
$T' \rightarrow * FT'$
$T' \rightarrow \in$
$F \rightarrow$ digit. **(08 Marks)**

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