CBCS SCHEME

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21CS51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 following terms :
i) String ii) Language iii) Alphabet iv) Length of string **(04 Marks)**

b. Explain the various phases of compiler with neat diagram. **(08 Marks)**

c. Define DFA and design a DFA to accept the following language:
i) To accept strings having even number of a's and odd number of b's.
ii) To accept strings of a's and b's not having the substring aab. **(08 Marks)**

OR

2 a. Design the equivalent DFA to the following ∈-NFA.

(05 Marks)

b. Minimize the following DFA by identifying distinguishable and non-distinguishable states.

	δ	0	1
→	A	B	F
	B	G	C
*	C	A	C
	D	C	G
	E	H	F
	F	C	G
	G	G	H
	H	G	C

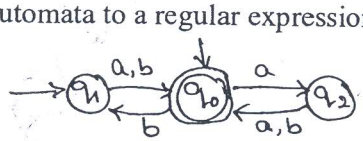
(10 Marks)

c. With neat diagram explain the components of language processing system in detail. **(05 Marks)**

Module-2

3 a. Define Regular Expressions. Write a regular expressions for the following :
i) $L = \{a^n b^m \mid n+m \text{ is even}\}$
ii) The set of all strings whose 3rd symbol from right end is 0
iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ **(10 Marks)**

b. Convert the following automata to a regular expression.



(04 Marks)

c. Explain the concept of input buffering in the Lexical Analysis along with sentinels. **(06 Marks)**

OR

4 a. State and prove Pumping Lemma for regular languages and also prove the language $L = \{a^n b^n \mid n \geq 0\}$ is not a regular. **(10 Marks)**

b. Construct ∈-NFA for the following regular expression
(0 + 11) 0*1 **(04 Marks)**

c. Define Token, Lexeme and Pattern with example. **(06 Marks)**

Module-3

5 a. Define CFG. Write a CFG to the following languages.
i) All strings over {a, b} that are even and odd Palindromes.
ii) $L = \{a^n \mid n \geq 0\}$ **(10 Marks)**

b. Define ambiguity. Consider the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$
Construct the leftmost and rightmost derivation, parse tree for the string id + id * id.
Also show that the grammar is ambiguous. **(10 Marks)**

OR

6 a. Consider the CFG given below with the production set, compute the following for the same.
(i) First( ) and Follow( ) set (ii) Predictive Parsing table
Grammar is,

$E \rightarrow TE'$
$E' \rightarrow +TE' \mid E$
$T \rightarrow FT'$
$T' \rightarrow *FT' \mid E$
$F \rightarrow (E) \mid id$ **(14 Marks)**

b. Write an algorithm to eliminate lift recursion from a grammar. Also eliminate lift recursion from the grammar

$S \rightarrow Aa \mid b$
$A \rightarrow Ac \mid Sd \mid \in$ **(06 Marks)**

Module-4

7 a. Define PDA. Design PDA for the language $L = \{WCW^R \mid W \in (a, b)\}$ and also show the Instaneous Description (ID) for the input aabCbaa. **(10 Marks)**

b. Construct LR(0) automata for the grammar given below.

$S \rightarrow L = R \mid R$
$L \rightarrow *R \mid id$
$R \rightarrow L$ **(10 Marks)**

OR

8 a. Define shift reduce Parser and Handle. Also list and explain the different actions operations available in Bottom up parser. **(10 Marks)**

b. Construct the LR(1) automata for the given grammar.

$S \rightarrow AA$
$A \rightarrow aA \mid b$ **(10 Marks)**

Module-5

9 a. Design a Turing machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ **(10 Marks)**

b. Write a short note on the following :
(i) Post correspondence problem (ii) Design issues in code generation **(10 Marks)**

OR

10 a. Translate the arithmetic expression $a = b * -c + b * -c$ into
(i) Three address code (ii) Quadruple (iii) Triple **(10 Marks)**

b. Write a short note on :
(i) Decidable language (ii) Halting problems in Turing machines. **(10 Marks)**

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