

CBCS SCHEME



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21CS51

Fifth Semester B.E. Degree Examination, June/July 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 terminologies with appropriate examples and notations:
 - i) Kleene star ii) Alphabet iii) Language iv) Power of an alphabet (08 Marks)
- b. Design a DFA to accept the language
 $L = \{ w \mid w \text{ is of even length and begins with } 01 \}$ (07 Marks)
- c. Explain briefly phases of a compiler. (05 Marks)

OR

- 2 a. Define with terminologies different ways of representing Automata considering an example. (08 Marks)
- b. Consider the following ϵ -NFA Fig.Q2(b).

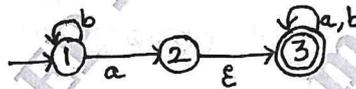


Fig.Q2(b)

- i) Compute the ϵ -Closure of each state ii) Convert the automation to a DFA (07 Marks)
- c. Explain in brief commonly used compiler construction tools. (05 Marks)

Module-2

- 3 a. Write regular expression (RE) for the following Languages.
 - i) The set of all strings such that the number of 0's is ODD. $\Sigma = \{0, 1\}$
 - ii) Every ODD length string begins with 11. $\Sigma = \{0, 1\}$ (08 Marks)
- b. Convert the following FSM into RE using state elimination technique. Refer Table Q3(b).

δ	0	1
$\rightarrow q_1$	q_2	q_1
q_2	q_2	q_4
$*q_3$	q_4	q_2
$*q_4$	q_4	q_1

Table Q3(b)

- c. Describe the languages denoted by the following regular expressions :
 - i) $a.(a + b)^*.b$ ii) $(a + b)^*.a.(a + b)(a + b)$ (05 Marks)

OR

- 4 a. Write Regular Expressions for the following languages:
 - i) All strings of lowercase letters that contain the five vowels in order. (08 Marks)
 - ii) All the strings of a's and b's that contain the substring abb. (08 Marks)
- b. Convert the following DFA in Fig.Q4(b) to a Regular Expression using Kleene's theorem.

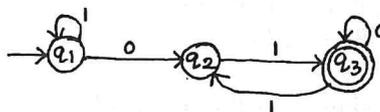


Fig.Q4(b)

- c. Explain with neat diagram interactions between the lexical analyzer and the parser. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Design Context-Free Grammars (CFG) for the following languages:
- $L = \{a^i b^j c^k \mid i = j = k\}$
 - The set of all strings of 0's and 1's where the number of 0's is equal to the number of 1's. **(08 Marks)**
- b. Given the Context-Free Grammar below:
- $$S \rightarrow AS \mid \varepsilon$$
- $$A \rightarrow aa \mid ab \mid ba \mid bb$$
- Give leftmost and rightmost derivations and parse tree for the following strings:
- aaba
 - baabab
 - aaabbb
- (06 Marks)**
- c. Construct the top-down parse tree for string $w = id + id * id$ by using grammar given below:
- $$E \rightarrow TE'$$
- $$E' \rightarrow +TE' \mid \varepsilon$$
- $$T \rightarrow FT'$$
- $$T' \rightarrow *FT' \mid \varepsilon$$
- $$F \rightarrow (E) \mid id$$
- (06 Marks)**

OR

- 6 a. Remove ambiguity from the Grammar given below:
- $$S \rightarrow aSb$$
- $$S \rightarrow aaSb$$
- $$S \rightarrow \varepsilon$$
- (08 Marks)**
- b. Consider the Context – Free Grammar given below:
- $$S \rightarrow aB \mid bA$$
- $$A \rightarrow a \mid aS \mid bAA$$
- $$B \rightarrow b \mid bS \mid aBB$$
- The string $w = 'aaabbabbba'$ and find
- Left-most derivation
 - Right-most derivation
 - Parse-tree
- (06 Marks)**
- c. Explain the role of Parser in the compiler model. **(06 Marks)**

Module-4

- 7 a. Design PDA to accept the language
- $$L = \{WcW^R \mid W \in \{a, b\}^*\}$$
- Write ID for $W = 'bacab'$ **(10 Marks)**
- b. Construct bottom-up parse tree for the following input strings by considering grammar given below:
- $$E \rightarrow E + T \mid T$$
- $$T \rightarrow T * F \mid F$$
- $$F \rightarrow (E) \mid id$$
- $W_1 = id * id$ $W_2 = id + id * id$ **(10 Marks)**

OR

- 8 a. Design a ND-PDA to accept the language
- $$L = \{a^m b^n \mid m \neq n, n, m > 0\}$$
- and write ID for $W = aaabb$ **(10 Marks)**
- b. Explain LR – Parsing algorithm in detail. **(10 Marks)**

Module-5

- 9 a. Design Turing Machine for the language
 $L = \{ a^i b^j \mid i > 0 \}$
Write ID for string $W = "aabb"$ (10 Marks)
- b. Write a short note on the following topics:
i) Recursive Languages (10 Marks) ii) Universal Turing Machines (10 Marks)

OR

- 10 a. Construct Direct Acyclic Graph (DAG) and corresponding three address code for the following expressions:
i) $a + a * (b - c) + (b - c) * d$
ii) $((x + y) - ((x + y) * (x - y))) + ((x + y) * (x - y))$ (10 Marks)
- b. Write a short note on the following :
i) Multitape Turing Machine
ii) Non-Deterministic Turing Machine (10 Marks)

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