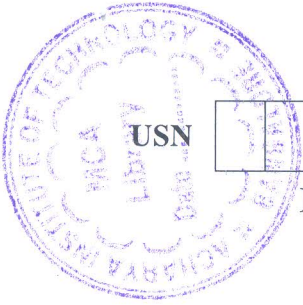


CBCS SCHEME



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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).

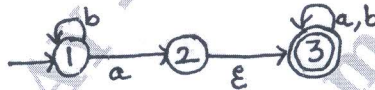


Fig.Q2(b)

- 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
$\rightarrow q_1$	q2	q1
q2	q2	q4
*q3	q4	q2
*q4	q4	q1

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.
 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.

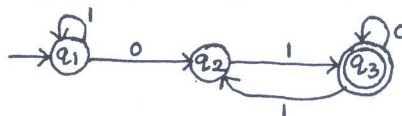


Fig.Q4(b)

- 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:

i) $L = \{a^i b^j c^k \mid i = j = k\}$

ii) 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:

i) aaba ii) baabab iii) 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

i) Left-most derivation ii) Right-most derivation iii) 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
 $L = \{ a^i b^i \mid i > 0 \}$
Write ID for string $W = "aabb"$ (10 Marks)
- b. Write a short note on the following topics: (10 Marks)
- i) Recursive Languages ii) Universal Turing Machines

OR

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

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