



2022/TDC/ODD/SEM/CSCHCC-501T/090

TDC (CBCS) Odd Semester Exam., 2022

COMPUTER SCIENCE

(Honours)

(5th Semester)

Course No. : CSCHCC-501T

(Theory of Computation)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

1. Answer any two of the following questions :

2×2=4

(a) What are the three parts of TOC?

(b) What is the difference between Σ^* and Σ^+ ? What is null string?

(c) How do you relate L^+ and L^* ?



(2)

2. Define language. Discuss the various operations performed on a language. 10

Or

(a) Given $L_1 = \{a, ab, a^2\}$ and $L_2 = \{b^2, aba\}$ are the languages over $\Sigma = \{a, b\}$. Determine $L_1 \cdot L_2, L_2 \cdot L_1$. 2+2=4

(b) Given $L = \{a^n b : n \geq 0\}$ over $\Sigma = \{a, b\}$.
(i) Obtain Σ^* .
(ii) What kind of strings are accepted by the language L ?
(iii) Give an example of finite language over Σ . 2+2+2=6

UNIT—II

3. Answer any two of the following questions : 2×2=4

(a) What do you mean by regular expression? Give example.

(b) State the difference between DFA and NFA.

(c) Write down the applications of pumping lemma.

(3)

4. (a) Give the formal definition of DFA. Also construct DFA for the languages over $\Sigma = \{a, b\}$ which accept strings that start with a and end with b . 2+4=6

(b) Show that language $L = \{a^P | P \text{ is a prime}\}$ is not regular. 4

Or

(a) Write down the closure properties of regular language. 4

(b) Obtain the RE for the following over $\Sigma = \{a, b\}$: 2+2=4

(i) Strings containing not more than two a 's

(ii) Strings which end with b

(c) What is transition graph? Give example. 2

UNIT—III

5. Define the following terms (any two) : 2×2=4

(a) CFG

(b) Parse tree

(c) Ambiguous grammar



(4)

6. (a) Obtain the languages generated by the following grammar : 5

$$\begin{aligned} S &\rightarrow aS \\ S &\rightarrow e \end{aligned}$$

(b) Construct CFG that generates the following language : 5

$$\{WCW^R : W \in \{a, b\}^*\}$$

Or

(a) Consider a CFG given by the production rules

$$\begin{aligned} S &\rightarrow a \\ S &\rightarrow aAS \\ A &\rightarrow bS \end{aligned}$$

Obtain the derivation tree of the word $W = abaabaa$. 4

(b) What is left linear grammar? Give example. 2

(c) Show that the following grammar is ambiguous : 4

$$\begin{aligned} S &\rightarrow aSb \mid SS \\ S &\rightarrow e \end{aligned}$$

(5)

UNIT—IV

7. Answer any two of the following questions : 2×2=4

- (a) How many tuples are there in PDA? Which data structure is used in PDA?
- (b) Define pumping lemma for CFL.
- (c) Which one is powerful PDA or DFA? Why is it?

8. (a) Construct PDA for the language $L = \{WCW^R : W \in \{a, b\}^*\}$ 5

(b) Discuss the various properties of CFL. 5

Or

(a) Explain CNF and GNF with examples. 5

(b) Construct PDA for the language $L = \{a^n b^{2n} : n \geq 1\}$. 5

UNIT—V

9. Answer any two of the following questions : 2×2=4

- (a) How do you differentiate TM from PDA?



(6)

(b) Write formal definitions of turing machine.

(c) What do you mean by halting problem?

10. Write short notes on the following : 4+3+3=10

(a) Universal TM

(b) Unsolvable problem

(c) Decidable language

Or

(a) Design TM for the language
 $L = \{a^n b^n c^n : n \geq 0\}$. 5

(b) What is REL? How does it differ from
RENL? 5
