

Total Pages : 4

B.Sc./5th Sem (H)/Comp/22(CBCS)

2022

5th Semester Examination
COMPUTER SCIENCE (Honours)

Paper : C 12-T

Theory of Computation

[CBCS]

Full Marks : 60

Time : Three Hours

The figures in the margin indicate full marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

1. Answer any *ten* questions of the following : $2 \times 10 = 20$

- (a) Define CFG.
- (b) What is positive closure ? Give an example.
- (c) What do you mean by Kleene's Star ?
- (d) What is Chomsky Normal Form ?
- (e) What do you mean by 'Dead State' in context of DFA.
- (f) Give two difference between DFA and NFA.
- (g) Design a regular expression for the language containing even number of 0's followed by odd number of 1's.

P.T.O.

- (h) State pumping lemma for context free language.
- (i) What is recursively enumerable language ?
- (j) What is an ambiguous grammar ? Give an example.
- (k) Differentiate regular expression and regular language.
- (l) What are the different types of language accepted by PDA ?
- (m) Consider the following statements —
 - (i) If $L_1 \cup L_2$ is regular, then both L_1 and L_2 must be regular.
 - (ii) The class of regular languages is closed under infinite union.

Which of the above statement is/are true ?

- (n) Explain the closure properties of a regular set.
- (o) What is parse tree ?

Group - B

2. Answer any **four** questions of the following : $5 \times 4 = 20$

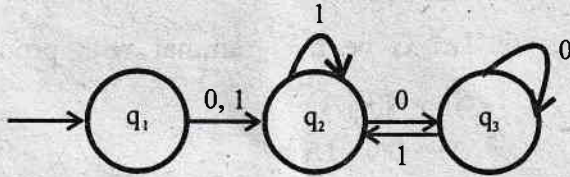
- (a) Prove that,

$$(1+00^*1) + (1+00^*1)(0+10^*1)^*(0+10^*1) = 0^*1(0+10^*1)^*.$$

- (b) Design an NFA which accepts set of all binary strings containing 1100 or 1010.

(3)

- (c) Prove that the language $L = \{a^P \mid P \text{ is prime}\}$ is not regular.
- (d) Convert the NFA to DFA :



- (e) Let to be the grammar $S \rightarrow aB \mid ba$
 $B \rightarrow b \mid bS \mid aBB$
for the string aa a bba bbb a, find the right most derivation.
- (f) Convert the following grammar into CNF
 $S \rightarrow cBA, S \rightarrow A, A \rightarrow cB, A \rightarrow A bb S, B \rightarrow aaa$.

Group - C

3. Answer any *two* questions of the following : $10 \times 2 = 20$

- (a) Explain the different types of Turing Machine.
Design a Turing Machine that accepts the language of all strings over the alphabet $\Sigma = (a, b)$ whose second letter is b. 2+8
- (b) Explain chomsky classification of languages.
- (c) (i) Construct a DFA accepting all strings over $\{a, b\}$ ending in ab.

P.T.O.

- (ii) What is ambiguous grammar? Check whether the following grammar is ambiguous or not.

$$S \rightarrow aSa \mid bSb \mid a \mid b \mid \epsilon. \quad 5+5$$

- (d) (i) If $G = (\{S\}, \{0,1\}, \{S \rightarrow 0S1, S \rightarrow \Lambda\}, S)$, find $L(G)$.

- (ii) Let G be the grammar with productions

$$S \rightarrow 0B1A$$

$$A \rightarrow 0|0S|1AA$$

$$B \rightarrow 1|1S|0BB$$

for the string 00110101, find left most derivation and right most derivation. 5+5
