Total number of printed pages–4

53 (CS 502) THCP

2021

THEORY OF COMPUTATION

Paper : CS 502

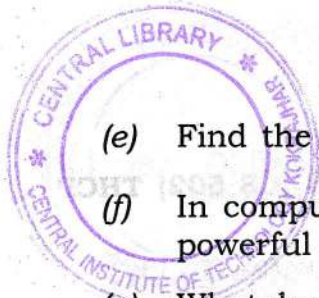*Full Marks : 100*

Time : Three hours

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

Answer Question No. **1** *and* **any four**
from the rest.

1. 2×10=20

    (a) What is regular language ?

    (b) Give an example of non-regular language.

    (c) What do you mean by context in a context free grammar ?

    (d) How many null string is in between *a* and *b* in the string *ab* ?

Contd.

(e) Find the power set of the set $\{q_0, q_1\}$.

(f) In computational aspect, who is more powerful DFA *or* NFA ?

(g) What do you mean by indistinguishable states ?

(h) Who is more powerful NPDA *or* DPDA ?

(i) What is parsing ?

(j) Arrange according to the computational power
TM, LBA, DPDA, NPDA, NFA, DFA.

2.   5+10+5=20

(a) Define DFA. Why is it deterministic ?

(b) Design a DFA for $L = \{w \in \{0, 1\}^*$ and binary representation of w is divisible by 5 $\}$.

(c) Explain where the concept of DFA is used in compiler.

3.   10+6+4=20

(a) Define regular expression. Write a regular expression of $L = \{w \in \{a, b\}^*$, where w contains at least two $a\}$.

(b) Convert the NFA to ε-free NFA.
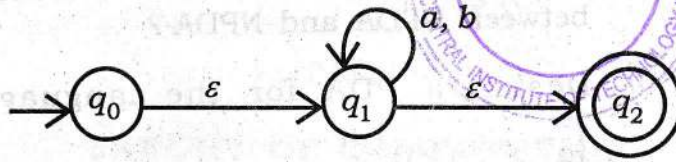
(c) Explain the concept of parallel computing in NFA.

4. 8+6+6=20

(a) Define grammar. Write a grammar for $L = \{ w \in \{a, b\}^*$, and w contains at least two $a\}$.

(b) Define CNF. What is left factoring in a grammar and how to remove it?

(c) Convert the grammar into CNF :

$$\{S \rightarrow a \mid aA \mid B, \ A \rightarrow aBB \mid \varepsilon, \ B \rightarrow Aa \mid b\}$$

5. State and prove the Pumping lemma for regular language. Hence prove that $\{a^n b^n : n \geq 0\}$ is not regular language.

20

6.   10+10=20

    (a) Define PDA. What is the difference between DPDA and NPDA ?

    (b) Design a PDA for the language $\{a^n b^n : n \geq 0\}$.

7.   5×4=20

    (a) Describe the accepting and rejecting criteria of TM.

    (b) Describe the Chomsky hierarchy of language.

    (c) Write a short note on Church-Turing thesis.

    (d) Describe about non-recursive language.