

2026

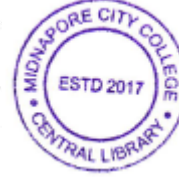
6th Semester Examination (CCFUP : NEP)

COMPUTER SCIENCE

Paper : MJ 11-T

(Single Core Major)

(Automata Theory)



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

Answer any *ten* questions : $2 \times 10 = 20$

1. Compare DFA and NFA in accepting languages.
2. Which Normal Forms are used for the representation of a CFG? Why?
- ~~3.~~ Explain any two closure properties of regular language.
4. Find the grammar for the language $L = a^n b^k c^n$, where $k \geq 3$ and $n \geq 0$.
- ~~5.~~ Write the language generated by the grammar $S \rightarrow aSb / aAb, A \rightarrow bAa / ba$.

$S \rightarrow aAc / aSc$
 $A \rightarrow aBc$
 $A \rightarrow ccc / cA$

P.T.O.

$S \rightarrow aSc / aAc$
 $A \rightarrow ccc / cA$

(2)

6. What is Kleene Star operation?
7. What is Pumping Lemma for regular languages?
8. What is a parse tree?
9. Define ambiguity in CFG
10. What is a pushdown automaton (PDA)?
11. What is the Halting Problem?
12. $\{0,1\}^*$, what does it mean?
13. What is unit production?
14. What is type 0 grammar?
15. What is power set?

Group - B

Answer any *four* questions :

5×4=20

16. Prove that the language $L = \{0^n 1^n \mid n > 0\}$ is not regular.
17. Derive any two representative strings with a minimum length of 5 from the following context-free grammar :
 $G = (\{S, A, B\}, \{a, b\}, P, S)$
 $S \rightarrow bA \mid aB$
 $A \rightarrow bAA \mid aS \mid a$
 $B \rightarrow aBB \mid bS \mid b$



(3)

18. Construct a Turing Machine that recognizes the language
 $L = \{a^n b^n c^n \mid n > 0\}$.
19. Explain the working of a pushdown automaton.
20. Explain the properties of transition function of a finite automata.
21. What is the use of read-write head in a Turing Machine?

Group - C

Answer any *two* questions :

10×2=20

22. Explain Chomsky's hierarchy and corresponding type0, type1, type2, and type3 formalism. Prepare a table indicating the automata and grammar for the languages in the Chomsky Hierarchy. Convert the following Mealy machine to an equivalent Moore machine in the tabular format.

Present State	I/P = 0		I/P = 1	
	Next State	O/P	Next State	O/P
Q ₁	Q ₂	1	Q ₁	0
Q ₂	Q ₃	0	Q ₄	1
Q ₃	Q ₁	0	Q ₄	0
Q ₄	Q ₃	1	Q ₂	1

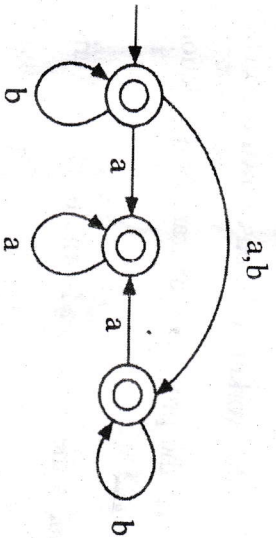
4+2+4

P.T.O.

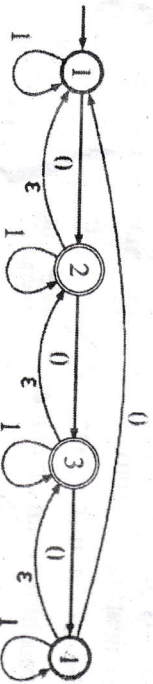


(4)

23. Find the Regular Expression (R.E.) for the following Finite Automata :



Convert the following NFA with ϵ to a DFA using the ϵ -closure method :



4+6

24. (a) Design a DFA for strings over $\{0, 1\}$ that end with "01".

(b) Prove that regular languages are closed under union.

6+4

(5)

25. Minimise the following DFA :

