

I Semester M.C.A. (Two Years Course) Examination, July 2023
(CBCS) (2020-2021 and Onwards)
COMPUTER SCIENCE
1 MCA 4 : Theory of Computation

Time : 3 Hours

Max. Marks : 70

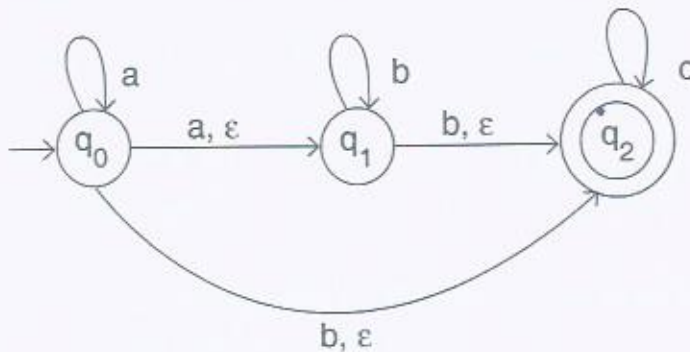
Instructions : Part – A : Attend **any five** questions.
Part – B : Attend **any four** questions.

PART – A

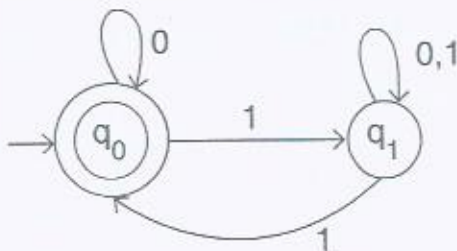
Answer **any five full** questions.

(5×6=30)

1. Define ϵ -closure. Find ϵ -closure of all states for the given ϵ -NFA.



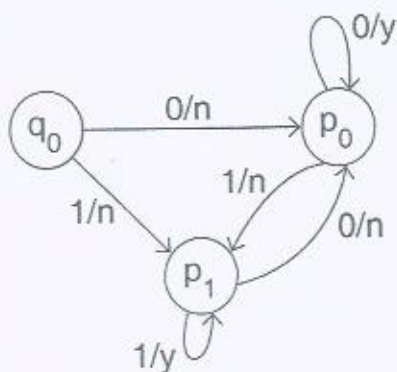
2. Convert the following NFA to DFA.



3. Regular languages are closed under union and intersection. Justify.
4. State and prove pumping lemma for regular languages.



5. Convert the following Mealy machine to Moore machine.



6. Define ambiguous grammar. Check whether the following grammar is ambiguous.

$$S \rightarrow aB \mid bA$$

$$A \rightarrow aS \mid bAA \mid a$$

$$B \rightarrow bS \mid aBB \mid b$$

7. Convert the following grammar into PDA.

$$S \rightarrow aABC$$

$$A \rightarrow aB \mid a$$

$$B \rightarrow bA \mid b$$

$$C \rightarrow a$$

8. Write a short note on Halting problem of Turing Machine.

PART – B

Answer **any four full** questions.

(4×10=40)

9. a) Explain extended transition function of DFA. 4
- b) Draw a DFA to accept strings of a's and b's having even number of a's and even number of b's. 6



10. Define equivalent and non equivalent states and minimize the following DFA. 10

	1	0
→ A	B	C
B	C	D
C	C	E
* D	D	D
* E	E	E
F	F	E

11. a) Write a short note on Chomsky Hierarchy of languages. 5

b) Construct an NFA with ϵ -moves for Regular Expression $(a+b)^* cd$. 5

12. a) Obtain a CFG for the language
 $L = \{a^n b^n \mid n \geq 1\}$. 4

b) Convert the following grammar into GNF. 6

$S \rightarrow A$

$A \rightarrow aBa|a$

$B \rightarrow bAb|b$

13. a) Design a Pushdown Automata to accept the Language
 $L = \{w \in w^R \mid w \in (a+b)^*\}$ 8

b) Check whether the string a a b c b a a is accepted or not. 2

14. a) Write a short note on variations of Turing Machine. 5

b) Prove that if a Language L and its complement L' both are RE then L is recursive. 5