DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY, C.S.J.M. UNIVERSITY, KANPUR

THEORY OF COMPUTATION (CSE-S304)

Semester: 2024-25 (Odd Semester) **Year: 3rd year(2k22- CSE)**

END SEMESTER EXAMINATION

Time: 3 h **Maximum marks: 50**

Note:- All questions are compulsory

Section A

10 marks (10 Questions of 1 Mark each)

1. What are some real-world applications for finite state machine?
2. What are the three ways to simplify a context free grammar?
3. What is the significance of the Chomsky hierarchy?
4. What is the difference between Mealy Machine and Moore Machine?
5. What is non deterministic PDA?
6. Define a parse tree in the context of context-free grammars
7. What is the use of pumping lemma?
8. What is the difference between context free and context sensitive grammar?
9. State the four components of a Turing machine.
10. What is the Halting Problem, and why is it important?

Section B

20 marks (5 Questions of 4 Marks each)

11. Construct the PDA M accepting $L = \{ a^n\ b^m\ a^n \mid m,n >=1 \}$ by null store.
12. Construct the finite automata equivalent to regular expression $10 +(0+11)0^*1$.
13. Prove that the language $L= \{a^n b^n c^n : n>=1\}$ is not regular..
14. Construct the PDA A equivalent to the following context-free grammar: S→0BB, B→0S|1S|0.

    Test whether 010^4 is accepted by empty store.
15. Consider the following productions: S→aB|bA , A→aS|bAA|a, B→bS|aBB|b
    Find the leftmost, rightmost derivation and derivation tree For the string "aaabbabbba".

Section C

20 marks (2 Questions of 10 Marks each)

16. Construct the PDA for the language $L= \{ w\ c\ w^R \mid w \in (a + b)^*\}$ where w^R is reverse of w. And show processing of any string.
17. What do you understand by Turing Machine explain it by transition diagram.

    Design Turing machine M to recognize the language $L = \{ 1^n\ 2^n\ 3^n \mid n>=1\}$.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY, C.S.J.M. UNIVERSITY, KANPUR

Theory of Computation (CSE-S304)

Semester: 2024-25 (Odd Semester) **Year: 3rd Year (2k22-CSE)**

MID SEMESTER EXAMINATION-SEP2024

Time: 1.5 h **Maximum marks: 30**

All questions are compulsory

Section A

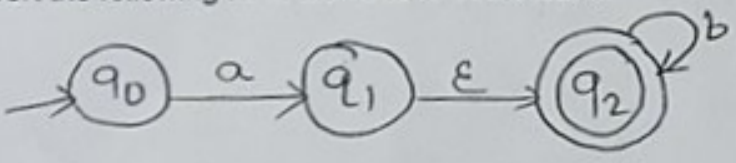
9 marks (9 Questions of 1 mark each)

1. Finite automata cannot recognize the language consisting of strings with matching numbers of 0s and 1s. (T/F)
2. The union of two regular languages is regular. (T/F)
3. A finite automaton can have infinitely many states. (T/F)
4. The language accepted by a DFA is always a regular language. (T/F)
5. A deterministic finite automaton (DFA) can have multiple transitions for the same input symbol from a given state. (T/F)
6. Mealy and Moore machines are not equivalent in terms of computational power. (T/F)
7. The concatenation of two regular languages is always regular. (T/F)
8. The output of a Moore machine depends on the input symbol received at each step. (T/F)
9. The set of all strings over {a, b} that contain "aa" as a substring is a regular language. (T/F)

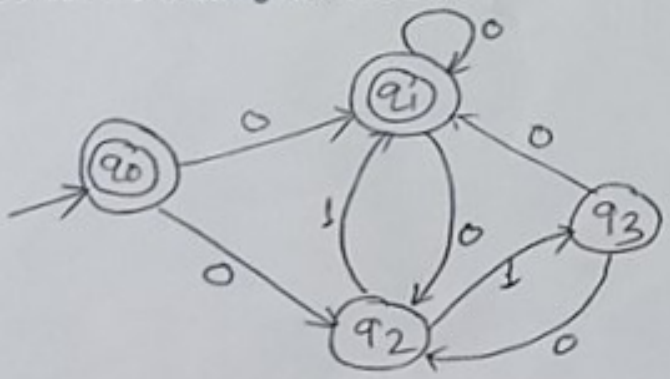
Section B

9 marks (3 Questions of 3 mark each)

10. Design FA which checks whether a given binary number is divisible by three.
11. Convert the following NFA with ε to NFA without ε.



12. Convert the following NFA into DFA



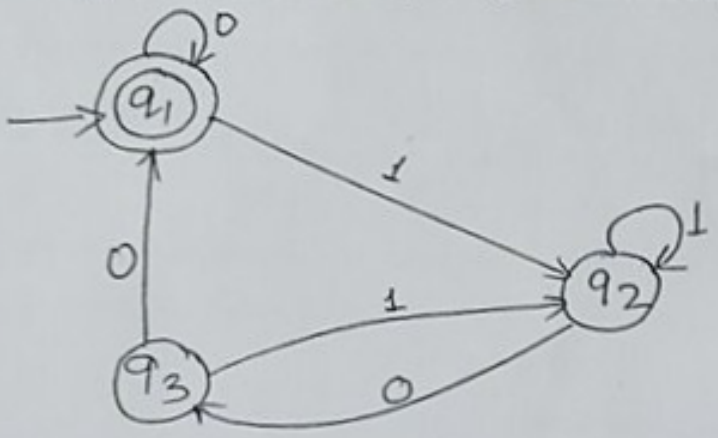
Section C

12 marks (2 Questions of 6 mark each)

13. Construct Minimum State Automaton for the following DFA.

State	a	b
→ q0	q1	q0
q1	q0	q2
q2	q3	q1
(q3)	q3	q0
q4	q3	q5
q5	q6	q4
q6	q5	q6
q7	q6	q3

14. Construct the regular expression Corresponding to the State Diagram.



$0^* 1 + (1^*(01)^*) + ((10)^* 0)^*$

$0^* 1 (1^*(01)^*)(\underline{(ba)^* a})$
$\underline{b^*(ab)^*}$

$(0 + (10)^* 0)^* 1 (1^*(01)^*)$