Roll Number												

Narula Institute of Technology

An Autonomous Institute under MAKAUT

2023

END SEMESTER EXAMINATION - ODD 2023

IT305 - FORMAL LANGUAGE AND AUTOMATA THEORY

TIME ALLOTTED: 3Hours **FULL MARKS: 70**

Instructions to the candidate:

Figures to the right indicate full marks.
Draw neat sketches and diagram wherever is necessary.
Candidates are required to give their answers in their own words as far as practicable

Group A
(Multiple Choice Type Questions)

Answer any ten from the following, choosing the correct alternative of each question: 10×1=10

1. Moore Machine is an application of: (1) CO1 BL1
a) Finite automata without input
b) Finite automata with output
c) Non Finite automata with output
d) None of the mentioned

2. For a give Moore Machine, Given Input=’101010’, thus the output would be of length: (1) CO3 BL2
a) |Input|+1
b) |Input|
c) |Input-1|
d) Cannot be predicted

3. Which of the following is not an example of finite state machine system? (1) CO1 BL3
a) Control Mechanism of an elevator
b) Combinational Locks
c) Traffic Lights
d) Digital Watches

4. Which is true of the following? (1) CO1 BL1
a) Merger graph is directed graph
b) Compatible graph is directed graph
c) Both are directed
d) None of these.

5. Transition function maps. (1) CO1 BL1
a) Σ * Q -> Σ

b) Q * Q -> Σ

c) Σ * Σ -> Q

d) Q * Σ -> Q

6. A Language for which no DFA exist is a_____ (1) CO3 BL2
a) Regular Language

b) Non-Regular Language

c) May be Regular

d) none of these

7. Regular expression for all strings over (a,b) starts with ab and ends with bba is. (1) CO4 BL2
a) aba*b*bba

b) ab(ab)*bba

c) ab(a+b)*bba

d) none of these

8. Push down automata accepts _____ languages. (1) CO3 BL3
a) Type 3

b) Type 2

c) Type 1

d) Type 0

9. Which among the following looks similar to the given expression? (1) CO3 BL3
((0+1). (0+1)) *

a) {xϵ {0,1} *|x is all binary number with even length}

b) {xϵ {0,1} |x is all binary number with even length}

c) {xϵ {0,1} *|x is all binary number with odd length}

d) {xϵ {0,1} |x is all binary number with odd length}

10. Simplify the following regular expression: (1) CO3 BL2
ε+1*(011) *(1*(011) *) *

a) (1+011) *

b) (1*(011) *)

c) (1+(011) *) *

d) (1011) *

11. A Turing machine is a (1) CO4 BL5
a) real machine
b) hypothetical machine
c) abstract machine
d) All of these

12. A regular language over an alphabet ∑ is one that cannot be obtained from the basic languages using the operation (1) CO2 BL1
a) Union

b) Concatenation

c) Closure

d) All of the mentioned

Group B
(Short Answer Type Questions)
(Answer any three of the following) 3x5=15

13. Explain Left recursion and Left factoring (5) CO1 BL2

14a. State Pumping lemma for Regular Sets. (3) CO1 BL2

14b. What is meant by ambiguous grammar? Explain with example. (2) CO1 BL2

15. Construct an equivalent FA for the given regular expression (0+1)*(00+11)(0+1)*. (5) CO3 BL4

16. Consider the following table and find a minimum length sequence that distinguishes state A from state B. (5) CO2 BL3

Present State	Next State, z	
	x = 0	x = 1
A	B, 1	H, 1
B	F, 1	D, 1
C	D, 0	E, 1
D	C, 0	F, 1
E	D, 1	C, 1
F	C, 1	C, 1
G	C, 1	D, 1
H	C, 0	A, 1

17. Construct a minimum state automaton equivalent to the finite automaton given in the table below. (5) CO3 BL4

State / Input	0	1
→ q0	q1	q5
q1	q6	q2
(q2)	q0	q2
q3	q2	q6
q4	q7	q5
q5	q2	q6
q6	q6	q4
q7	q6	q2

Group C
(Long Answer Type Questions)
(Answer any three of the following) 3x15=45

18a. Explain with example Chomsky Hierarchy (7) CO1 BL1

18b. Construct DFA for the given NFA (5) CO1 BL2

	Next state	
	0	1
→ q0	q0,q1	q0
q1	q2	q1
q2	q3	q3
(q3)	-	q2

18c. Compare DFA and NFA. (3) CO1 BL1

19a. (5) CO2 BL3

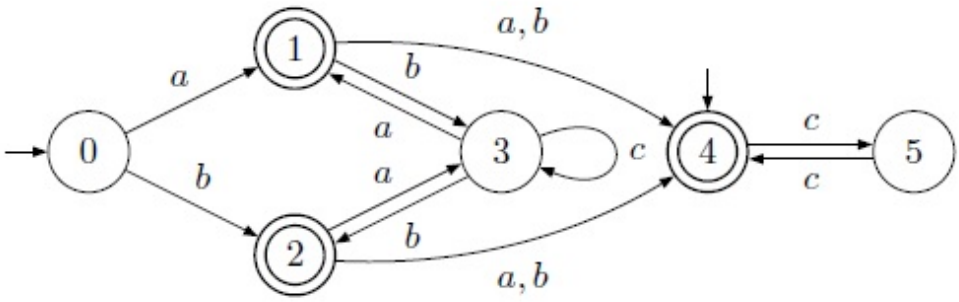
Construct a Mealy machine which is equivalent to the Moore machine given in table.

Present State	Next State		Output
	a=0	a=1	
→ q_0	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	0

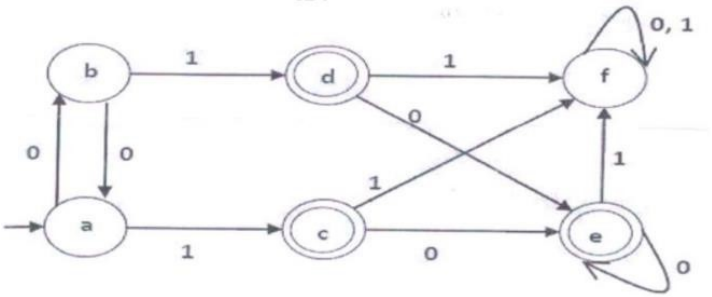
19b. Design a PDA to accept the language L= $\{a^n b^n \mid n > 0\}$ (5) CO4 BL3

19c. Write short note on Merger Graph. (5) CO1 BL2

20a. Construct the equivalent DFA from the NFA given below. Write down the transition table for both the automata. (6) CO3 BL3



20b. Minimize the following automata. (9) CO2 BL3



21a. Design a Turing machine to recognize the language $\{1^n2^n3^n \mid n >= 1\}$ (7) CO3 BL3

21b. Convert the following grammar into GNF - (8) CO3 BL3
S -> AB, A -> BS | b, B -> SA | a

22a. Design a 2-I/P and 2-O/P sequence detector, which will detect a sequence 1010 and produce one as Output, else will produce zero as output. Design the circuit implementation (10) CO4 BL5

22b. Design a serial binary adder. (5) CO4 BL5
