GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

FORMAL LANGUAGE AND AUTOMATA THEORY

IT305

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

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
(Multiple Choice Type Questions)

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

			Marks	CO No
1.	i)	The format: A->aB refers to which of the following? a) Chomsky Normal Form b) Greibach Normal Form c) Backus Naur Form d) None of the mentioned	1	CO4
	ii)	The logic of pumping lemma is a good example of a) The Pigeon-hole Principle b) The Divide and Conquer technique c) Recursion d) Iteration	1	CO2
	iii)	Which among the following are incorrect regular identities? a) εR=R b) ε*=ε c) Φ*=ε d) RΦ=R	1	CO3
	iv)	A Shift Register is a) Mealy m/c b) Turing m/c c) Moore m/c d) All of these	1	CO3
	v)	The solution of the equation R=Q+RP is a) R=QP* b) P=RQ* c) R=Q*P d) None of the above	1	CO2
	vi)	In Moore machine if the input string is of length n then output string is of length – a) n b) n/2 c) n+1 d) 2n	1	CO2

vii) Pumping lemma is generally used for — 1 — CO2
a) A given grammar is regular
b) A given grammar is not regular
c) Whether two regular expression are equivalent or not
d) None of these

viii) A grammar G=(V, T, P, S) is _____ if every production taken one of the two forms: — 1 — CO3
B->aC
B->a
a) Ambiguous
b) Regular
c) Non Regular
d) None of the mentioned

ix) An automata is a/an ..... device — 1 — CO5
a) Acceptor only
b) Rejector only
c) Acceptor/rejector
d) generating

x) There are _____ tuples in finite state machine. — 1 — CO4
a) 4
b) 5
c) 6
d) Unlimited

xi) Which among the following looks similar to the given expression? ((0+1). (0+1)) * — 1 — CO2
a) {x∈ {0,1} *|x is all binary number with even length}
b) x∈ {0,1} |x is all binary number with even length}
c) {x∈ {0,1} *|x is all binary number with odd length}
d) {x∈ {0,1} |x is all binary number with odd length}

xii) In Moore machine, output is produced over the change of: — 1 — CO1
a) Transitions
b) States
c) all of the mentioned
d) none of the mentioned

GROUP – B
(Short Answer Type Questions)
Answer any ***three*** from the following: **3×5=15**

Marks **CO No**

2. (a) Convert the following Moore machine into Mealy machine: — 3 — CO1

PRESENT STATE	NEXT STATE		OUTPUT
	a=0	a=1	
→q_1	q_1	q_2	0
q_2	q_1	q_3	0
q_3	q_1	q_3	1

(b) Convert the following NFA into an equivalent DFA (Note that q_3 is Final State) — 2 — CO1

PRESENT STATE	NEXT STATE	
	a=0	a=1
→q_0	q_0, q_1	q_0, q_2
q_1	q_3	-
q_2	-	q_3
*q_3	q_3	q_3

3. Check the Definiteness of the following m/c, if definite, find out its order — 5 — CO2

PS	NS,Z	
	X=0	X=1
A	C	B
B	E	F
C	A	F
D	E	B
E	C	D
F	E	F

4. (a) Consider the following CFG: — 4 — CO1
S→aaB, A→bBb/ ε, B→Aa .
Find the parse tree for the string "aabbababa"

(b) What is Ambiguous grammar? — 1 — CO3

5. Construct a minimum state automaton equivalent to a DFA whose transition table is given below (where q_3 and q_4 are two final states): — 5 — CO1

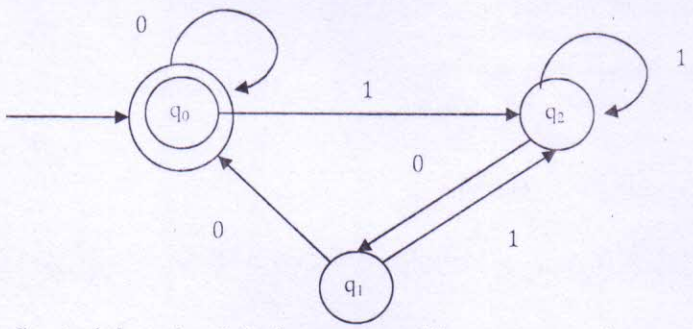
Present State	Next State	
	a=0	a=1
→q_0	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

6. (a) State Arden's Theorem. — 2 — CO3

(b) Define Kleen's Star and Positive Closure with example — 3 — CO3

GROUP – C
(Long Answer Type Questions)
Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Construct the regular expression corresponding to the state diagram given below:	4	CO3



(b) Define Left factoring & Left recursion with proper example. — 5 — CO1

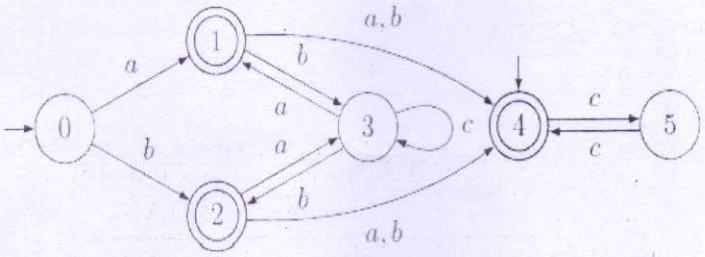
(c) Convert the following grammar to GNF — 6 — CO4
S→AB, A→BS/a, B→SA/b

8. (a) Find the equivalence class partition of the machine shown below: 9 CO2

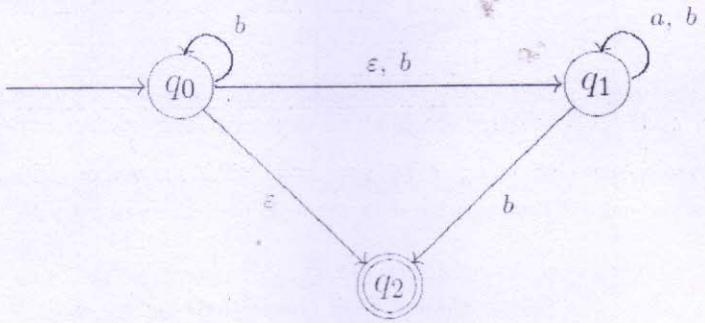
PRESENT STATE	NEXT STATE, z	
	x=0	x=1
A	E,0	D,1
B	F,0	D,0
C	E,0	B,1
D	F,0	B,0
E	C,0	F,1
F	B,0	C,0

(b) Show a standard form of the corresponding reduced machine for the above machine 6 CO4

9. (a) Construct the equivalent DFA from the NFA given below. Write down the transition table for both the automata. 8 CO2



(b) Show the ε- closures from the following. Then Remove ε-transition from the following NFA. 7 CO2



10. (a) Find the CFG for the given Language: 5 CO5
L={x∈{0,1}*|number of zeroes in x=number of one's in x}

(b) Construct a push down automata for the language $L=\{ww^R \mid w \in \{a,b\}^*\}$ 6 CO3

(c) Using Pumping Lemma check whether $L=\{a^n b^n \mid n \geq 1\}$ is regular or not. 4 CO3

11. Write short notes on any three of the followings: 3x5=15

(a) Ambiguity and Inherent Ambiguity 5 CO4

(b) Turing machine 5 CO1

(c) Pumping lemma for Regular Set 5 CO2

(d) Classification of languages and their relations 5 CO2

(e) Compatibility Graph 5 CO3