GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
FORMAL LANGUAGE AND AUTOMATA THEORY
IT403

TIME ALLOTTED: 3 Hrs **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)	For a give Moore Machine, Given Input='101010', thus the output would be of length: a) |Input|+1 b) |Input| c) |Input-1| d) Cannot be predicted	1	CO4
	(ii)	The compatibility graph is used in searching for a) Minimal closed covering b) All incompatible pairs c) Minimum number of edges d) Both (a) and (c)	1	CO2
	(iii)	The regular expression representing the set of all strings {x, y} ending with XX & beginning with Y a) XX(X+Y)*Y b) Y(X+Y)*XX c) YY(X+Y)*X d) Y(XY)*XX	1	CO3
	(iv)	Which of the following strings can be obtained by the language $L=\{a^i b^{2i} \mid i \geq 1\}$ a) aabbbb b) aabbaa c) aaabbb d) bbaaaa	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

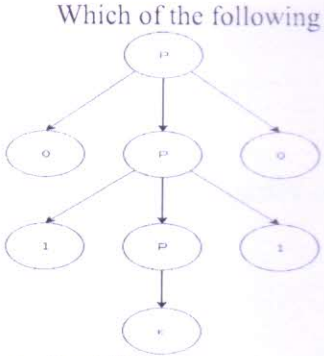
(vii) According to the given table, compute the number of transitions with 1 as its symbol but not 0: 1 CO2

Q	Δ(q,0)	δ(q,1)
q0	{q0}	{q0, q1}
q1	{q2}	{q2}
q2	{q3}	{q3}
q3	Φ	Φ

a) 4
b) 3
c) 2
d) 1

(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) Which of the following does the given parse tree correspond to? 1 CO5



a) P->1100
b) P->0110
c) P->1100ε
d) P->0101

(x) A context free grammar is a _____ 1 CO4
a) English grammar
b) Regular grammar
c) Context sensitive grammar
d) None of the mentioned

(xi) Which among the following looks similar to the given expression? ((0+1). (0+1)) * 1 CO2
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}

(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) Simplify the given grammar: 2 CO1
S->aXb
X->aXb | e

3. (a) Consider the following grammar: 3 CO2
S→ 0B/ 1A, A→ 0/0S/ 1AA, B→ 1/1S/ 0BB.
For the string 00110101,
Find the leftmost derivation

(b) Draw the derivation tree for the above derivation. 2 CO2

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. State and Prove the Arden's Theorem. 5 CO3

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

			Marks	CO No
7.	(a)	Prove that (1+00*1) + (1+00*1) (0+10*1)* (0+10*1) =0*1(0+10*1)*.	4	CO3
	(b)	Define Left factoring & Left recursion with proper example.	5	CO1
	(c)	Convert the following grammar to GNF S→AB, A→BS/a, B→SA/b	6	CO4
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

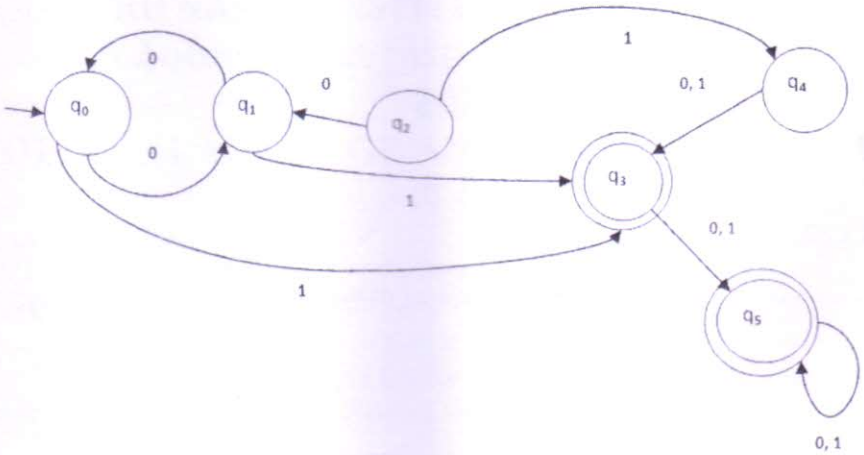
	(b)	Show a standard form of the corresponding reduced machine for the above machine	6	CO4
9.	(a)	Convert the following Mealy machine into Moore machine:	5	CO2

PRESENT STATE	NEXT STATE			
	a=0		a=1	
	STATE	OUTPUT	STATE	OUTPUT
→q_1	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

	(b)	Consider the following table and find a minimum length sequence that distinguishes state A from state B.	4	CO2

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

	(c)	Minimize the states in the DFA depicted in the following diagram:	6	CO1



10.	(a)	Find the CFG for the given Language: L={x∈{0,1}*|number of zeroes in x=number of one's in x}	5	CO5
	(b)	Construct a push down automata for the language L={ww^R | w ∈ {a,b}*}	6	CO3
	(c)	Using Pumping Lemma check whether L={$a^n b^n$ | n≥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)	Merger Graph	5	CO3