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DEPARTMENT OF SCIENCES, III SEMESTER M.Sc (Applied Mathematics and Computing) END SEMESTER EXAMINATIONS, NOVEMBER 2019

SUBJECT: Formal Language and Theory of computation [MAT 5001]

(REVISED CREDIT SYSTEM-2017)

Note:(i) Answer ALL questions. All questions carry equal marks(3+3+4)(ii) Draw diagrams, and write equations wherever necessary

- 1A. Draw a block diagram of finite automaton with proper explanation and also express it analytical form.
- 1B. Prove that a context –sensitive language is recursive.
- 1C. Construct a minimum state automaton equivalent to a given automaton M whose transition table is given below:

States	In	put
	a	b
$\rightarrow q_0$	<i>q</i> ₀	93
q_1	92	95
92	<i>q</i> ₃	94
<i>q</i> ₃	90	95
94	90	96
95	91	94
(96)	<i>q</i> ₁	93

- 2A. Prove $(1 + 00^*1) + (1 + 00^*1)(0 + 10^*1)^*(0 + 10^*1) = 0^*1(0 + 10^*1)^*1$.
- 2B. Construct a regular expression corresponding to the following FA shown in figure using algebraic method.



- 2C. Design a FA to check whether a given unary number is divisible by three. Test it for the string 111111.
- 3A. Define ambiguous grammar. Show that the grammar

 $S \rightarrow a \mid abSb \mid aAb, A \rightarrow bS \mid aAAb$ is ambiguous.

- 3B. State and prove Kleene's Theorem.
- 3C. State and prove two properties of transition functions.
- 4A. Show that the set $L = \{0^i 1^i | i \ge 1\}$ is not regular.
- 4B. With suitable explanation, construct an equivalent Machine for the given Machine:

State	i.p. a	=0	i.p. a=1		
	State	o.p.	state	o.p.	
$\rightarrow q_1$	q ₃	0	q ₂	0	
q_2	\mathbf{q}_1	1	q 4	0	
q ₃	q ₂	1	\mathbf{q}_1	1	
q 4	q 4	1	q ₃	0	

- 4C. Prove that if L is regular then L^T is also regular.
- 5A. Construct a deterministic finite automaton equivalent to the grammar

 $S \rightarrow aS \mid bS \mid aA, A \rightarrow a, A \rightarrow bB, B \rightarrow aC, C \rightarrow \Lambda$

- 5B. Design a Moore machine that will read sequences made up of the letters A, E, I,O, U and will give as an output the same sequences except that in this case as I directly follows an E, it will be changed to U.(eg. Sequence E O I A I E gives an output E O I A I U).
- 5C. Define pushdown automaton. Draw its model with proper labelling and explanation. Mention which language it accepts.
