Code No: RT22055 **R13** SET - 1

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What is a state and write about few types of states? (4M)
   b) What is a string? Write about concatenation of two strings? (3M)
   c) Write the design strategy for NFA-ε ? (4M)
   d) Write about unreachable and dead states with illustration? (4M)
   e) Write about Leftmost derivation and rightmost derivation with example? (4M)
   f) Explain about offline Turing Machine? (3M)

PART -B

2. a) Explain the design of a finite state machine with an example? (10M)
   b) Explain the advantages of Finite State Machine? (6M)

3. a) What are Generative grammars? Write the components of such grammars? Explain with example the types of generative grammars? (8M)
   b) Show that the language $L=\{ww^R \mid w \in \{a,b\}^*\}$ is generated with context free grammar? (8M)

4. a) Write the Algorithm for minimizing DFA? (4M)
   b) Reduce the following DFA where q_1 is the start state and q_6 is the final state. (6M)

δ	0	1
q_1	q_2	q_3
q_2	q_4	q_5
q_3	q_6	q_7
q_4	q_4	q_5
q_5	q_6	q_7
q_6	q_4	q_5
q_7	q_6	q_7

   c) Construct a regular expression corresponding to the DFA represented by the below transition table. q_1 is both the initial state and final state. (6M)

δ	0	1
q_1	q_1	q_2
q_2	q_3	q_2
q_3	q_1	q_2
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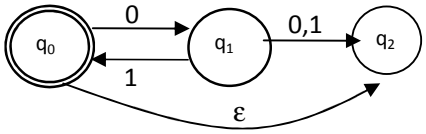
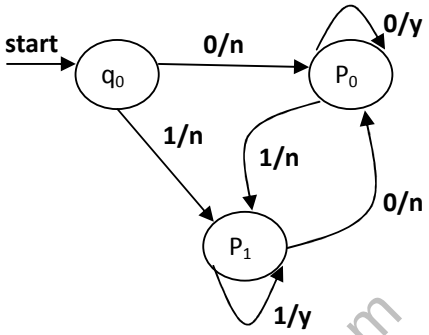
5. a) What is NFA? Explain the transitions of NFA? (4M)
   b) Construct an NFA that accepts the set of all strings over {0,1} that start with 0 or 1 and end with 10 or 01. (5M)
   c) Construct a DFA equivalent to the NFA given below (7M)



6. a) Convert the following Mealy machine to an equivalent Moore machine (8M)



   b) Explain different types of grammar with example? (8M)

7. a) Design a Turing Machine "Parity Counter" that outputs 0 or 1, depending on whether the number of 1's in the input sequence is even or odd respectively. (10M)
   b) What are P and NP class of Languages? What is NP Complete and give examples? (6M)

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PART –A

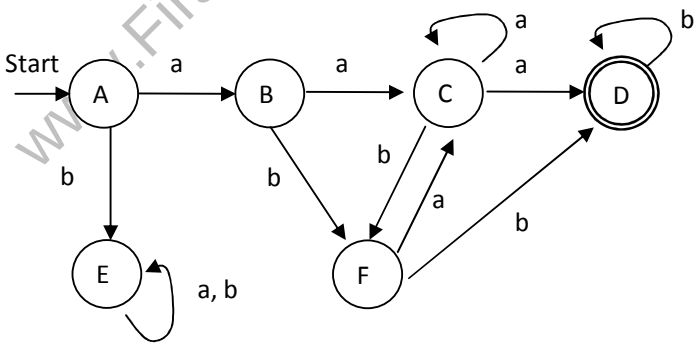
1. a) What is a transition? How are they represented? (4M)
   b) What is Kleene Closure and Positive Closure? (4M)
   c) What are the advantages of NFA over DFA? (3M)
   d) Differentiate DFA and 2DFA? (4M)
   e) Bring out the differences between Moore and Mealy machines? (4M)
   f) Explain about Multi Dimensional Turing Machine? (3M)

PART -B

2. a) Write about the Mathematical representation of Finite State Machine FSM? (8M)
   b) Explain the applications of Finite State Machine in real world? (8M)

3. a) What is a context free Language? Give examples? Write about the properties of context free languages? (8M)
   b) Show that $L=\{a^{n!} \mid n>=0\}$ can be generated with unrestricted grammar? (8M)

4. a) Reduce the DFA given below (6M)



   b) Construct an NFA with ε moves for $00^{*}+1$ (6M)
   c) Write the steps to construct regular expression from given DFA? (4M)
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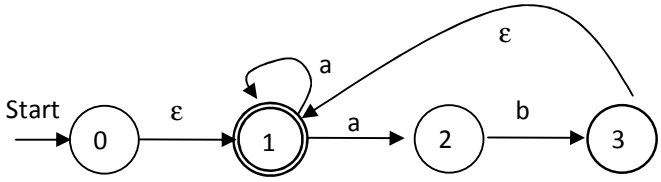
Code No: RT22055 **R13** SET - 2

5. a) What is DFA? Explain the transitions of DFA? (4M)
   b) Construct a DFA accepting the language (5M)
   { W ∈ {a,b}* | W has neither aa nor bb as substring}
   c) Convert the following NFA-ε to NFA (7M)



6. a) Obtain a grammar to generate the language L = {$a^i b^j c^k$ | i+2j=k, i>=0, j>=0} (8M)
   b) Simplify the following CFG and Convert it into CNF (8M)
   S -> AaB | aaB
   A -> ε
   B -> bbA | ε

7. a) Design a Turing Machine "Parantheses Checker" that outputs 1 or 0 depending on whether the sequence is properly formed or not? (8M)
   b) What is Halting Problem of Turing Machine? Is it decidable or not? Explain? (8M)

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PART –A

1. a) What is a state diagram? (3M)
   b) What is a formal language? Write the ways in which formal language can be specified? (4M)
   c) Write the design strategy for NFA? (4M)
   d) Write about indistinguishable and distinguishable states with illustration? (4M)
   e) Differentiate ambiguous and unambiguous grammar with example? (4M)
   f) Explain Church Turing Thesis? (3M)

PART –B

2. a) What is Automata? Explain classification of Automata? (8M)
   b) Write in detail about Models of Computation? (8M)

3. a) Write in detail the Chomsky hierarchy of formal languages? (8M)
   b) Show that the language L ={$a^n b^n c^n$ ln>=0} is not context free. (8M)

4. a) Construct a DLA accepting the language ; $\{w \in \{a,b\}^* = w\}$ has neither aa nor bb as subming (8M)
   b) Construct an NFA for r = $(a+bb)^* ba^*$ (8M)

5. a) Discuss the properties of Regular Expressions and Regular Languages. (8M)
   b) State and prove Arden's theorem. (8M)

6. a) Design a mealy machine to print out 1's complement of an input bit string? (8M)
   b) Write the general procedure to transform a grammar to Greibach Normal Form? (8M)

7. a) Design a Turing Machine to compute Max(n_1, n_2)? (8M)
   b) Explain about Universal Turing Machine? (8M)
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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

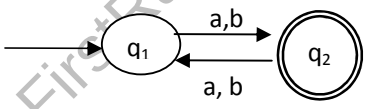
1. a) What is a state transition table? (3M)
   b) Consider a language L^* where L={ab, cd} with Σ = {a, b}. What is the shortest string in Σ^* that is not in the language L^*? (4M)
   c) Write the design strategy for DFA? (4M)
   d) Write the procedure to detect indistinguishable state? (4M)
   e) Write the general procedure to transform a grammar to Chomsky Normal Form? (4M)
   f) Explain about Multi Head Turing Machine? (3M)

PART -B

2. a) What are the components of Finite state Automata? Give examples of Finite state machine? (8M)
   b) Explain the disadvantages of Finite State Machine? (8M)

3. a) What are formal languages? Write about the different types of formal languages? (8M)
   b) Show that L = { a^p | p is prime} is generated with context sensitive grammar? (8M)

4. a) What is minimal DFA? Write the minimization Algorithm for DFA? (4M)
   b) Construct an NFA for the regular expression $(a+b)^*$ (aa+bb) $(a+b)^*$ (6M)
   c) Construct a regular expression for the given transition diagram (6M)



5. a) Construct a NFA equivalent to the regular expression (10+11)*00. (8M)
   b) Check wither the following time DFA's are equal or not (8M)

	0	1
q_1	q_1	q_2
q_2	q_3	q_1
q_3	q_2	q_3
	0	1
q_4	q_4	q_5
q_5	q_5	q_4
q_6	q_7	q_6
q_7	q_6	q_4

6. a) Design a Mealy machine to add two binary numbers of the form $x_1x_{2...}x_k$, $y_1y_{2...}y_k$? (8M)
   b) Prove that S -> aSbS | bSaS | ε is ambiguous. (8M)

7. a) Design a Turing Machine to accept the language L = {W W^R | W∈ $(a+b)^*$} (10M)
   b) Differentiate Turing Machines and Real Machines? (6M)
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