# Nirma University

Institute of Technology
Semester End Examination (IR), December - 2017
B. Tech. in Computer Engineering / Information Technology, Semester-V
CE501 Theory of Computation

		Supervisor's ini- with date	tial	
lours			Max. Marks	: 100
<ol> <li>Figures to</li> <li>Draw nea</li> <li>Assume s</li> </ol>	o right indicate at sketches wh suitable data w	erever necessary. herever necessary and		
o as directed.				[16]
anguage correspo a. b* (ab) *a* b. (a*+b*)(a*+b c. a*(baa*)*b* d. b*(a+ba) *b*	onding to the	e given regular expi	ression.	[4]
nguages. Σ={a,b} . The language of . The language of . The language of . The language of	f all strings f all strings f all strings f all strings	containing exactly to containing at least that do not end wit that begin or end w	two b's. two a's. h ab vith aa or bb	[4]
				[4]
anguage accepted inal state of the r	d by the give machine? (o	en DFA is (a+b(b+aa go:initial state)		[4]
-				
	2. Figures to 3. Draw nea 4. Assume s 5. Steps / P  o as directed.  a each case below anguage correspondate the regular anguages. Σ={a,b}. The language of The language of Explain in brief anguage accepted angu	1. Attempt all questions. 2. Figures to right indicate 3. Draw neat sketches wh 4. Assume suitable data w 5. Steps / Process should  to as directed.  a each case below, find a string anguage corresponding to the a. b* (ab) *a* b. (a*+b*)(a*+b*)(a*+b*) c. a*(baa*)*b* d. b*(a+ba) *b* ind the regular expression anguages. Σ={a,b} The language of all strings Consider the following finite anguage accepted by the give anal state of the machine? (questions)  State δ(q,a)  questions  [State δ(q,a)  ] [State δ(q,a)	s: 1. Attempt all questions. 2. Figures to right indicate full marks. 3. Draw neat sketches wherever necessary. 4. Assume suitable data wherever necessary and 5. Steps / Process should be mentioned clearly for the given regular expression as directed.  a each case below, find a string of minimum length anguage corresponding to the given regular expression as b* (ab) *a* b. (a*+b*)(a*+b*)(a*+b*) c. a*(baa*)*b* d. b*(a+ba) *b* ind the regular expression and finite autonguages. Σ={a,b} The language of all strings containing exactly to the language of all strings that do not end with the language of all strings that begin or end with the language of all strings that begin or end with the language of all strings that begin or end with the language of and strings that begin or end with the language of and strings that begin or end with the language of and strings that begin or end with the language of and strings that begin or end with the language accepted by the given DFA is (a+b(b+aatanguage accepte	Since 1. Attempt all questions.  2. Figures to right indicate full marks.  3. Draw neat sketches wherever necessary.  4. Assume suitable data wherever necessary and mention the same.  5. Steps / Process should be mentioned clearly for each question.  5. Steps / Process should be mentioned clearly for each question.  6. as directed.  6. each case below, find a string of minimum length in {a, b}* not in the anguage corresponding to the given regular expression.  a. b* (ab) *a*  b. (a*+b*)(a*+b*)(a*+b*)  c. a*(baa*)*b*  d. b*(a+ba) *b*  ind the regular expression and finite automaton for following inguages. Σ={a,b}.  The language of all strings containing exactly two b's.  The language of all strings containing at least two a's.  The language of all strings that do not end with ab.  The language of all strings that begin or end with aa or bb explain in brief any 4 applications of Finite State Machine.  Consider the following finite state machine transition table. Now if the anguage accepted by the given DFA is (a+b(b+aa)*ab)* then which is the small state of the machine? (qo:initial state)  State δ(q,a) δ (q,b) qo qo qo qo qu

qo

q1

## Q-2. Answer the following.

[18]

(A) A finite state machine with the following state table has a single input 'X' and a single output 'Z'. If the initial state is unknown, then which is the shortest input sequence to reach the final state 'C'?

Present State	Next state Z	ate Z
	X=1	X=0
Α	D,0	B,0
В	B,1	C,1
C	B,0	D,1
D	B,1	C,0

(B) For the Moore Machine given in the following table. Find the equivalent [6] Mealy Machine, Start state in q<sub>0</sub>.

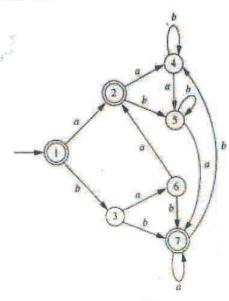
Current state	Input Symbol		Output
	а	Ъ	
q <sub>0</sub>	q <sub>1</sub>	q <sub>2</sub>	1
q <sub>1</sub>	q <sub>3</sub>	Q4	1
q <sub>2</sub>	Q4	q <sub>0</sub>	0
Q3	q <sub>1</sub>	q <sub>2</sub>	0
Q4	q <sub>3</sub>	qo	1

OR

- (B) Prove that for every  $n \ge 0$ ,  $n(n^2 + 5)$  is divisible by 6 using PMI.
- [6]

(C) Minimize the following FA.





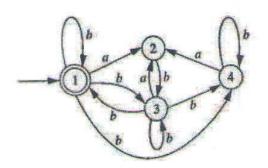
Prove that the language  $L = \{a^n \mid n \text{ is a prime number}\}$  is a regular or [6] (C) not using Pumping lemma.

### Answer the following. Q-3.

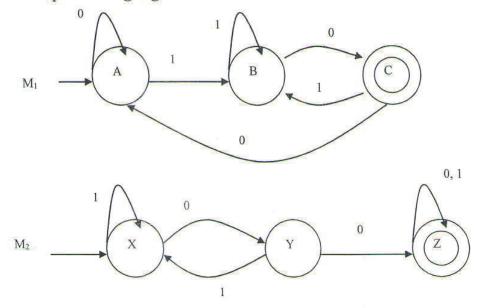
[16]

(A) Convert the following NFA to equivalent DFA.





Let M<sub>1</sub> and M<sub>2</sub> be two finite automata accepting the language L<sub>1</sub> and L<sub>2</sub> [8] (B) respectively as shown in following figure. Construct the finite automata to accept the language  $L = L_2 - L_1$ .



### Do as directed. Q-4.

(C)

[16]

[4] What do you mean by an ambiguous grammar, prove that the following (A) grammar is an ambiguous:  $E \rightarrow a \mid E+E \mid E-E \mid E*E \mid E/E$ 

Write CFG for the following: (B)

[4]

1.  $\{a^i b^j c^k \mid i = j + k\}$ 

2.  $\{a^i b^j c^k \mid j = i \text{ or } j = k\}$ 

Construct CFG for the following RE: (0 + 1)\* (01)\*

[4]

(D)	What is the difference between deterministic PDA and non-deterministic PDA, explain it with suitable example.	[4]
Q-5.	Answer the following.	[18]
(A)	Design a PDA for more number of a's as compare to b's.	[6]
(B)	Convert the following into GNF: $S \rightarrow XY$ $X \rightarrow YSY$ $X \rightarrow YY \mid 1$ $Y \rightarrow 0X1 \mid 1$	[6]
	OR	70
(B)	Design a PDA for the following CFG: S → b   bS   aSS   SSa   SaS	[6]
(C)	Design a TM over $\Sigma = \{a,b\}$ to accept the language $L = \{a^n b^n \mid n \ge 1\}$	[6]
	OR	
(C)	Write a note on Universal Turing Machine.	[6]
Q-6.	Answer the following.	[16]
(A)	Design CFG for the following PDA.	[8]
(22)	$\delta$ (qo, a, Zo) $\vdash$ (qo, aZo)	. 1
	$\delta$ (qo, a, a) $\vdash$ (qo, aa)	
	$\delta$ (q <sub>0</sub> , c, a) $\vdash$ (q <sub>1</sub> , a)	
	$\delta(q_1, a, a) \vdash (q_2, \epsilon)$	
	$\delta(q_2, a, a) \vdash (q_2, \epsilon)$	
(B)	$\delta(q_2, \mathcal{E}, Z_0) \vdash (q_2, \mathcal{E})$ Design a Turing Machine for Reversing a String.	[8]
1-1	DANIBUL A THINGS THE TOTAL TOT	1