Nirma University

Institute of Technology

Semester End Examination (RPR), May - 2018

B. Tech. in Computer Engineering / Information Technology, Semester-V

CE501 Theory of Computation

Roll/ Exam No		Supervisor's initial with date	

Time: 3 Hours | Max Marks: 100

Instructions:

1. Attempt all questions.
2. Figures to the right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume necessary data wherever required and state the assumptions.

Q-1. Do as directed. **[15]**

A) Prove that for every n ≥ 0, **[05]**

$$\sum_{i=1}^{n} (1/i(i+1)) = \frac{n}{n+1}$$

B) In each case the relation on the set {1,2,3} is given Determine relation (reflexivity, transitivity and symmetry) with reason. **[05]**

- R={(1,3),(3,1),(2,2)}
- R={(1,1),(2,2),(3,3),(1,2)}
- R= φ

OR

B) Construct an FA recognizing for (010 + 00)(11)*. **[05]**

C) Find the regular expression and finite automaton for following languages. **[05]**
Σ={a,b}

- The language of all strings containing exactly two a's.
- The language of all strings containing at least two a's.
- The language of all strings that do not end with ab

Q-2. Answer the following. **[15]**

A) Convert NFA-∧ with following transition table to equivalent FA. **[05]**
starting state = {1} and A = {1}

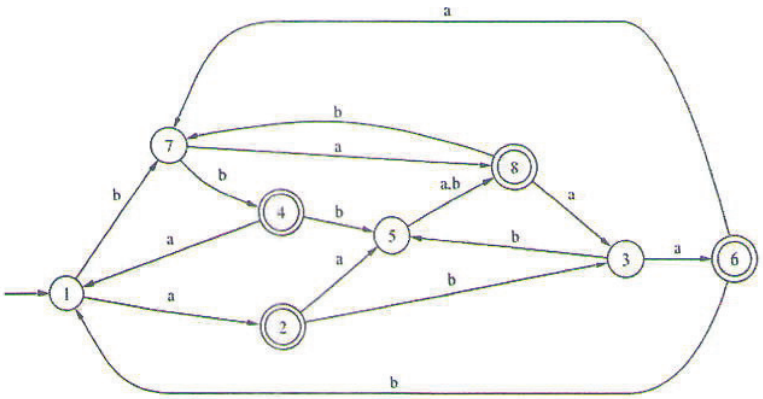
Q	δ(q, ∧)	δ(q,a)	δ(q,b)
1	ϕ	{2}	ϕ
2	ϕ	{5}	{3}
3	{1}	{4}	ϕ
4	ϕ	{3}	ϕ
5	{1}	ϕ	ϕ

B) Draw NFA - ∧ for regular expression aa(ba)* + b*aba* using Kleen's theorem and without using kleen's theorem **[05]**

C) Prove that for any integers *a* and *b*, if *a* and *b* are odd, then *ab* is odd. **[05]**

Q-3. Do as directed. **[20]**

A) Minimize the following Finite Automata. **[10]**



B) Let M1 and M2 are two FA recognizing languages L1 and L2 respectively, **[10]**
L1= The language of all strings ending with 01.
L2= The language of all strings contains odd length of string.
Draw the FA recognizing L1 U L2. Σ={a,b}

Q-4. Answer the following. **[15]**

A) Find CFG for following languages **[05]**
1) Odd length strings in {a,b}* whose first, middle and last symbols all are same.
2) Palindromes strings over { a,b}*

OR

A) Draw the PDA for the language L = { XcY where |X|=|Y| and X,Y ε {a,b}*} **[05]**

B) Construct a PDA for following languages. **[05]**
The language L= { x ∈ {a,b}* | $n_a(x) \neq n_b(x)$ }

C) Define the term regular grammar and its need in compiler construction. **[05]**

Q-5. Answer the following. **[15]**

A) Use pumping lemma to show the given language is not regular. **[05]**
L= $\{0^i1^i \mid i > 0\}$

B) Here is a context-free grammar: **[05]**

$S \rightarrow AB \mid CD$
$A \rightarrow BG \mid 0$
$B \rightarrow AD \mid \varepsilon$
$C \rightarrow CD \mid 1$
$D \rightarrow BB \mid E$
$E \rightarrow AF \mid B1$
$F \rightarrow EG \mid 0C$
$G \rightarrow AG \mid BD$

Find all the nullable symbols

C) "A standard example of ambiguity in programming language is dangling else". Explain it. **[05]**

OR

C) Convert following CFG to CNF (Chomsky Normal Form). **[05]**

S → AACD
A → aAb | null
C → aC | a
D → aDa | bDb | null

Q-6. Do as directed. **[20]**

A) Design a Turing machine for accepting the language $L = \{ ww \mid w \in \{a,b\}^* \}$ **[10]**

OR

A) Generate a bottom up PDA for following grammar. **[10]**
S → S[S] | null and Parse the string x = [ ][[ ]]

B) Draw a Turing machine to accept $L = \{0^i 1^{2i} \mid i>0 \}$. **[10]**