Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–II • EXAMINATION – SUMMER • 2014

Subject Code: 620007 **Date: 21-06-2014**

Subject Name: Theory of Computation

Time: 10:30 am - 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Write the regular expressions corresponding to each of the following: **07**

1. Strings of even length
2. Strings with odd number of 1's
3. Strings of length 3 or less
4. Strings that are valid C identifies
5. Strings ending in 11
6. Strings containing exactly two 0's
7. Stings ending in 01

(b) (i) Define regular language, $\sum^*$, L^*, L^+ **03**

(ii) Explain Logical Quantifiers and Quantified Statement **04**

Q.2 **(a)** Explain principle of mathematical induction. Solve the following: Prove that for every n ≥ 0, **07**

$$\sum_{i=1}^{k} i^2 = k(k+1)(2k+1)/6.$$

(b) i. Define NFA with suitable example in details. Also differentiate NFA and DFA **04**

ii. Prove that if either of a and b is even number then a*b is even number. **03**

OR

(b) Explain NFA-$\wedge$. What are different the kinds of non-determinism possible in NFA-$\wedge$? Also define $\wedge$ closure. **07**

Q.3 **(a)** An NFA with states 1-5 and input alphabet {a,b} has the following transition table: **07**

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

i. Calculate δ*(1, ab)

ii. Calculate δ*(1, abaab)

(b) Construct FA for the following regular expressions: **07**

i. (11 + 10)*

ii. (111 + 100)*0

OR

Q.3 **(a)** A transition table is given for an NFA-$\wedge$ with seven states **07**

q	$\delta(q,a)$	$\delta(q,b)$	$\delta(q, \wedge)$
1	ϕ	ϕ	{2}
2	{3}	ϕ	{5}
3	ϕ	{4}	ϕ
4	{4}	ϕ	{1}
5	ϕ	{6,7}	ϕ
6	{5}	ϕ	ϕ
7	ϕ	ϕ	{1}

Find the following:

i. $\delta^*(1, ba)$

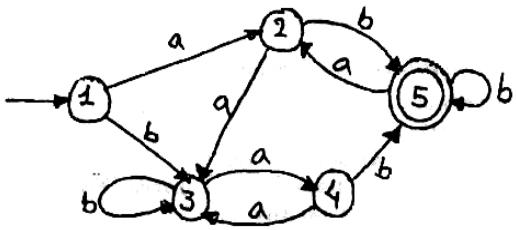
ii. $\delta^*(1, ababa)$

(b) Construct FA for the following regular expressions: **07**

i. $(0 + 1)^* 0$

ii. $(0 + 1)^*(1 + 00)(0 + 1)^*$

Q.4 **(a)** Find minimum state FA for the following: **07**



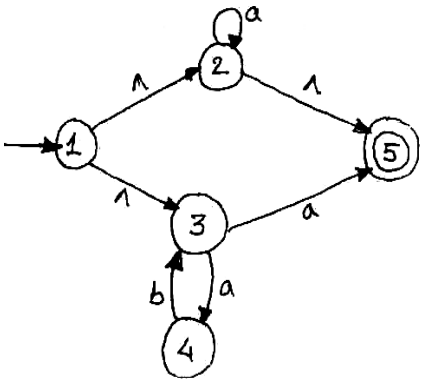
(b) Given that L1 = {x ε (0,1)* | x ends with 00} **07**

L2 = {x ε (0,1)* | x ends with 01}

Give FA for L1, L2 and L1 $\cap$ L2

OR

Q.4 **(a)** For the given NFA-$\wedge$ find the minimum state FA: **07**



Q.4 **(b)** Given that L1 = {x ε (0,1)* | x ends with 00} **07**

L2 = {x ε (0,1)* | x ends with 01}

Give FA for L1, L2 and L1 – L2

Q.5 **(a)** Write a short note on turing machines. Support with an example **07**

(b) Define PDA. Give a suitable example for the same. **07**

OR

Q.5 **(a)** Convert the following grammar into Chomsky normal form **07**

$S \rightarrow AACD$

$A \rightarrow aAb \mid \wedge$

$C \rightarrow aC \mid a$

$D \rightarrow aDa \mid bDb \mid \wedge$

(b) Write short notes on:

i. Pumping lemma **03**

ii. Recursively enumerable languages **04**

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