Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-VI Examination May 2011

Subject code: 160704

Subject Name: Theory of Computation

Date: 21-05-2011 **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 Answer the following. **14**

(a) Write Regular Expressions for the following languages of all strings in {0,1}*

(i) Strings that do not end with 01.

(ii) Strings with odd numbers of 1's (Ones).

(b) Define one-to-one, onto and bijection function.

Check whether the function f: R+ ---> R, $f(x) = x^2$ is one to one and onto.

(c) Define Nondeterministic Finite Automata (NFA) and write down recursive definition of δ* for NFA- Λ.

(d) Give the recursive definition of PAL of Palindrome over any alphabet ∑.

Q.2 **(a)** Write definition of Finite Automata and draw FA for the strings: **07**

(i) The string with next to last symbol as 0.

(ii) The string with number of 0s odd and number of 1s odd.

(b) Using Principle of Mathematical Induction, prove that for every n >= 1, **07**

$$\sum_{i=0}^{n} i = n(n+1)/2$$

OR

(b) Using Principle of Mathematical Induction, prove that for every n >= 1, **07**

$7 + 13 + 19 + \ldots + (6n + 1) = n(3n + 4)$

Q.3 **(a)** Convert following NFA- Λ to NFA and FA. **08**

q	δ (q, Λ)	δ(q, 0)	δ(q, 1)
A	{B}	{A}	Ø
B	{D}	{C}	Ø
C	Ø	Ø	{B}
D	Ø	{D}	Ø

(b) For the following Regular Expression draw an NFA- Λ recognizing the corresponding languages. **06**

(i) $(00 + 1)^* (10)^*$

(ii) 001^*0^*11

OR

Q.3 **(a)** Draw Finite Automata (FA) for following languages: **09**

L_1 = {x / 00 is not a substring of x }

L_2 = {x / x ends with 01 }

Find FA accepting languages (i) $L_1 \cap L_2$ and (ii) $L_2 - L_1$

(b) Compare FA, NFA and NFA- Λ with illustration. **05**

Q.4 **(a)** For the language L = { xcx^r / x Є {a,b}* } design a PDA(Push Down Automata) and trace it for string "abcba". **08**

(b) Define CFG. Prove that the following CFG is Ambiguous. **06**

S → S + S | S * S | (S) | a

Write the unambiguous CFG for the above grammar.

OR

Q.4 **(a)** Answer the following. **08**

(i) Design a CFG for the following language.

$L = \{ 0^i 1^j 0^k \quad / j > i + k \}$

(ii) Give the difference between Top Down Parsing And Bottom Up Parsing.

(b) Design and draw a deterministic PDA accepting "Balanced strings of Brackets" which are accepted by following CFG. **06**

S→ SS | [S] | { S } | Λ

Q.5 **(a)** Explain the following Terms: **09**

(i) P and NP Completemness.

(ii) Equivalence Relation.

(iii)Regular Grammar.

(b) Define Turing Machine. Describe its capabilities. Also write short notes on Universal Turing Machine. **05**

OR

Q.5 **(a)** Draw a Turing Machine(TM) to accept Palindromes over {a,b}. (Even as well as Odd Palindromes) **08**

(b) Explain in Brief: **06**

(i) Halting Problem.

(ii)Chomsky Normal Form(CNF).

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