

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (Old) EXAMINATION – WINTER 2019

Subject Code: 160704
Date: 11/12/2019
Subject Name: Theory Of Computation
Time: 02:30 PM TO 05:00 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) Explain one to one and onto functions with example. Give inverse of the function $f: \mathbb{R}^+ \rightarrow \mathbb{R}^+, f(X) = X^2$ **07**

(b) Prove $1+2+3+\dots+n = (n*(n+1)) / 2$ using Principal of Mathematical Induction **07**

Q.2 (a) Define Regular Expression. **07**

Find Regular Expression corresponding to each of the following subsets of $\{0,1\}^*$

- 1) The Language of all strings containing exactly two 0's
- 2) The Language of all strings that end with 01
- 3) The Language of all strings that begin or end with 00 or 11

(b) Draw FAs recognizing following languages, **07**

$L1 = \{ x \mid 00 \text{ is not a substring of } x \}$

$L2 = \{ x \mid x \text{ ends with } 01 \}$

Draw FA accepting the language $L1 \cup L2$

OR

(b) Explain Distinguishable strings with example. Draw FA corresponding to a Regular Expression (R.E.) $= (11+110)^*0$, where $\Sigma = \{0,1\}$ **07**

Q.3 (a) Define NFA - Λ . Give Recursive Definition of δ^* for DFA, NFA and NFA - Λ . **07**

(b) Draw NFA recognizing the language $(\{0,1\}^*\{10\} \cup \{00\}^*\{11\}^*)^*$ using kleene's theorem part 1, where $\Sigma = \{0,1\}$ **07**

OR

Q.3 (a) Define Pumping Lemma for Regular Languages. Show that following language is not a Regular Language using Pumping Lemma **07**

$L = \{0^i1^i \mid i \geq 0\}$, where $\Sigma = \{0,1\}$

(b) Define CFG. Give CFG for $L = \{0^i1^j0^k \mid j > i+k\}$ **07**

Q.4 (a) Convert following CFG to Chomsky Normal Form, **07**

(1) $S \rightarrow AACD$

(2) $A \rightarrow aAb \mid \Lambda$

(3) $C \rightarrow aC \mid a$

(4) $D \rightarrow aDa \mid bDb \mid \Lambda$

(b) Define PDA. Give DPDA for CFG $S \rightarrow SS \mid [S] \mid \{S\} \mid \Lambda$ **07**

OR

- Q.4** (a) Give Bottom Up PDA for following CFG, **07**
(1) $S \rightarrow S+T \mid T$
(2) $T \rightarrow T * a \mid a$
- (b) Prove that following Grammar is an Ambiguous Grammar **07**
 $S \rightarrow S+S \mid S*S \mid (S) \mid a$
Draw parse tree for string $a+a*a$ using above grammar
- Q.5** (a) Draw Turing Machine (TM) accepting Palindrome over $\{a,b\}$ **07**
(b) Explain following terms **07**
1) P and NP Completeness
2) Time and Space Complexity

OR

- Q.5** (a) Draw Turing Machine (TM) accepting $\{SS \mid S \in \{a,b\}^*\}$ **07**
(b) Explain unbounded minimization and μ recursive functions **07**

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