

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER • 2014

Subject Code: 160704

Date: 05-12-2014

Subject Name: Theory of Computation

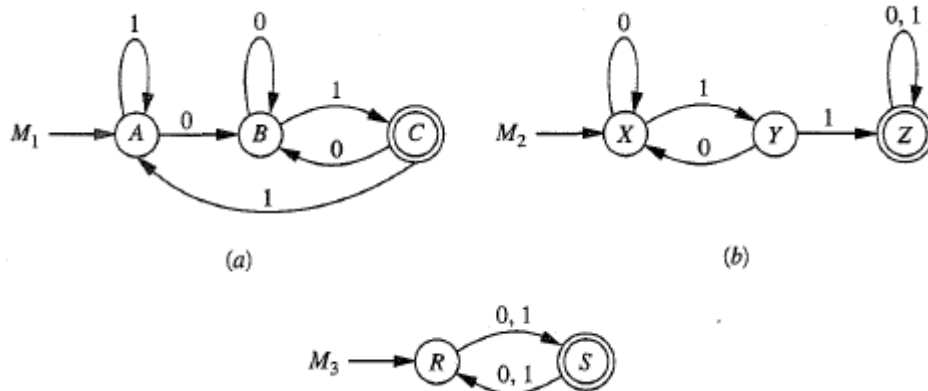
Time: 02:30 pm - 05:00 pm

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)** Answer the following: **07**
(i) Given the relation R in A as $R = \{(1,1), (2,2), (2,3), (3,2), (4,2), (4,4)\}$ is R (a) reflexive (b) symmetric (c) transitive? (d) antisymmetric?
(ii) Show that $2^n > n^3$ for $n > 10$ by Mathematical Induction.
- (b)** Answer the following: **07**
(i) Give recursive definition of each of the following sets.
a. The set T of positive integer divisible by 2 or 7.
b. The set U of all string in $\{0,1\}^*$ containing the substring 00.
(ii) Prove that for any every $n \geq 0, n(n^2+5)$ is divisible by 6.
- Q.2 (a)** Find a regular expression corresponding to each of the following subsets of $\{0, 1\}^*$. **07**
i. The language of all strings that do not contain the substring 110.
ii. The language of all strings containing both 101 and 010 as substrings.
iii. The language of all strings in which both the number of 0's and the number of 1's are odd.
- (b)** For each of the following regular expressions, draw an FA recognizing the corresponding language. **07**
i. $1(01 + 10)^* + 0(11 + 10)^*$
ii. $(010 + 00)^*(10)^*$
- OR**
- (b)** Let M_1, M_2 and M_3 be the FAs pictured in Figure below, recognizing languages L_1, L_2 , and L_3 respectively. **07**



Draw FAs recognizing the following languages.

- i. $L_1 \cup L_2$
- ii. $L_1 \cap L_2$
- iii. $L_1 - L_2$
- iv. $L_1 \cap L_3$
- v. $L_3 - L_2$

- Q.3

(a)

Explain Pumping Lemma and its applications.

07

(b)

Generate the Context-Free Grammars that give the following languages.
(i) $\{w \mid w \text{ contains at least three } 1s\}$
(ii) $\{w \mid w \text{ starts and ends with the same symbol}\}$

07
- OR
- Q.3

(a)

Write kleene's theorem part -1.

07

(b)

For given CFG G, find Chomsky normal form:
G has productions: $S \rightarrow AaA|CA|BaB$ $A \rightarrow aaBa|CDA|aa|DC$
 $B \rightarrow bB|bAB|bb|aS$ $C \rightarrow Ca|bC|D$ $D \rightarrow bD|\Lambda$

07
- Q.4

(a)

Write a Turing Machine to copy strings.

07

(b)

Write PDA for following languages:
 $\{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } j = i \text{ or } j = k\}$.

07
- OR
- Q.4

(a)

Write a Turing Machine to delete a symbol.

07

(b)

Write PDA for following languages:
 $\{x \in \{a,b,c\}^* \mid n_a(x) < n_b(x) \text{ or } n_a(x) < n_c(x)\}$.

07
- Q.5

(a)

Explain Universal Turing Machine and Halting Problem.

07

(b)

Answer the following
(i) Explain time and space complexity
(ii) Explain P and NP completeness

07
- OR
- Q.5

(a)

Explain unbounded minimization and μ recursive functions.

07

(b)

Top down and bottom up parsing.

07
