Student Exam No._____

GANPAT UNIVERSITY

B.Tech. Semester VI Computer Engineering/Information Technology

Regular Examination May/June – 2014

2CE601/2IT601: Theory of Computation

Max. Time : 3 Hour] **[Max Marks : 70**

Instructions: 1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Answer both sections in separate answer sheets.

SECTION-I

Q-1 **[A]** Prove using principle of mathematical induction that for any n>=0, **[4]**

$$\sum_{k=0}^{n} k^2 = n(n+1)(2n+1)/6$$

[B] Draw FA corresponds to regular expression (10+00)*. **[4]**

[C] Construct the relations with minimum elements on {1, 2, 3} that satisfy following properties. **[4]**
(a). No Reflexive, Symmetric, Transitive (b). No Reflexive, Symmetric, No Transitive

OR

Q-1 **[A]** Suppose r is a real number other than 1. Prove using principle of mathematical induction that for any n>=0, **[4]**

$$\sum_{k=1}^{n} r^k = \frac{1-r^{n+1}}{1-r}$$

[B] Draw an FA for the language of all strings in {a,b}* that contain either aa or bbb. **[4]**

[C] Write the regular expression on alphabet {0, 1} for following languages. **[4]**
1. The language of all strings that begins or ends with 01.
2. The language of all strings that begins with 0.

Q-2 **[A]** Draw an FA for the language of all string in {0,1}* with odd number of 1's and even number of 0's also find regular expression. **[6]**

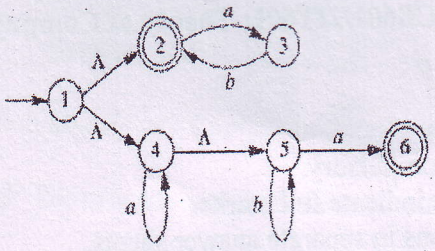
[B] Write a recursive definition for the language of all string with more a's than b's and prove it using structural induction. **[5]**

OR

Q-2 **[A]** Draw NFA-Null using KLEEN's theorem for expression 10(11)* + 0*(10)*00*. Clearly show separate NFA-Null for each step. **[6]**

[B] Write a recursive definition of string reverse function and prove that REV(x y) = REV (y) REV (x) for two strings x, y of some alphabet. **[5]**

Q-3 **[A]** For following figure draw NFA and FA accepting the same language. Also show some steps of converting following figure to NFA and FA. **[8]**



[B] In each case, say whether the statement is a tautology, a contradiction or neither. Give supporting proof. [4]

1. $Q \vee (Q \rightarrow P)$ 2. $(Q \rightarrow P) \wedge (\neg P \rightarrow Q)$

SECTION – II

Q-4 [A] Give transition table for deterministic PDA accepting following language: [6]
$L = \{ x \in \{0,1\}^* / n_0(x) > n_1(x)\}$ (i.e. number of zero's are more than number of one's).

[B] Using pumping lemma for regular language prove that language $L = \{WW^r \mid W \in \{a,b\}^*\}$ is not a regular language. [4]

[C] Give CFG for regular expression (00+11)*(01+10)*. [2]

OR

Q-4 [A] Give transition table for deterministic PDA accepting following language: [6]
$L = \{ x \in \{0,1\}^* / n_0(x) = n_1(x)\}$ (i.e. number of zero's are equal to number of one's).

[B] Use the pumping lemma to show that following language is not context free language: [4]
$L=\{ ss \mid s \in \{a,b\}^*\}$.

[C] Explain Chomsky Hierarchy of Grammar. [2]

Q-5 [A] Draw a Turing Machine to accept language generated by grammar S→^ | a | b | aSa | bSb. [6]

[B] Explain derivation tree, left most derivation, right most derivation and ambiguity in grammar with Example. [5]

OR

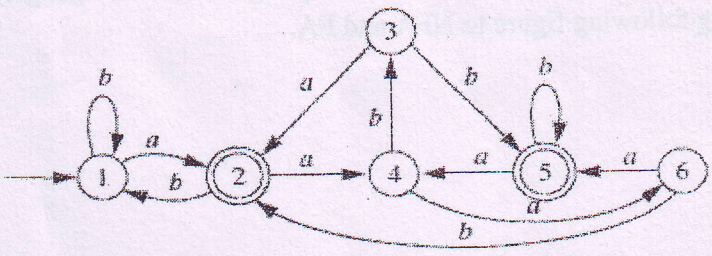
Q-5 [A] Draw a Turning Machine for language $L= \{ 0^n 1^m \mid n<m \text{ and } n>=0 \}$. [6]

[B] Give CFG for following languages: [5]

1. $L=\{ I^i J^j K^k \mid i=j \text{ or } i=k \text{ and } i,j,k >=1 \}$
2. $L=\{ 0^k 1^j \mid k<2j \}$

Q-6 [A] Convert the following CFG to Chomsky normal form (CNF) [6]
S→AACD , A→aAb | Λ , C→ aC | a |A , D→aDa | bDb | Λ

[B] For the following FA find the minimum state FA accepting the same language. [6]



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