Student Exam No.______________

GANPAT UNIVERSITY

B. Tech. Semester VI Computer Engineering/Information Technology

Regular Examination April-June 2015

2CE601/2IT601: Theory of Computation

Time: 3 Hours **Total Marks:** 70

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

SECTION – I

Q-1 [A] Prove by contrapositive that for every three positive integers i, j and n, if $i * j = n$, then either $i \leq \sqrt{n}$ or $j \leq \sqrt{n}$. [4]

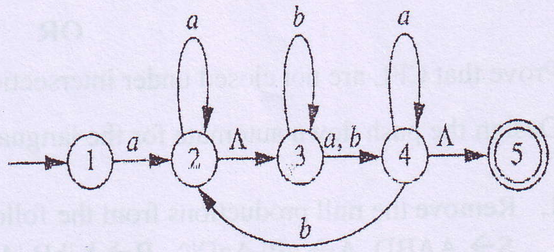
[B] Draw DFA for following Regular Expressions. [8]
1. (110 + 001)*
2. (0+1)*110

OR

Q-1 [A] Write regular expressions on alphabet {0,1} for the following languages. [6]
1. Language of all strings not containing substring 11.
2. Language of all strings containing at least two 1's.
3. Language of all strings with second last symbol is 0.

[B] Use principle of mathematical induction to prove following: [6]
$1^2 + 2^2 + \cdots + n^2 = n(n+1)(2n+1)/6$.

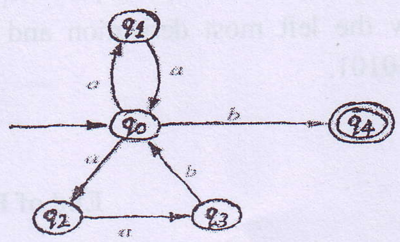
Q-2 [A] For following NFA-^ find $\delta^*(1, ab)$ and $\delta^*(1, aa)$ and say whether strings "ab" and "aa" can be accepted or not. [6]



[B] Draw FA, NFA and NFA-^ for regular expression 0+1. [5]

OR

Q-2 [A] For following NFA find $\delta^*(q_0, aab)$ and $\delta^*(q_0, ab)$ and say whether strings "aab" and "ab" can be accepted or not. [6]



[B] Show that $(P \to Q) \wedge (R \to Q) = (P \vee R) \to Q$ [5]

Q-3 [A] State true or false for followings: [5]

1. $1^* (1+ \wedge) = 1^+$
2. For NFA, δ is defined as $Q X \Sigma \rightarrow Q$.
3. If $\delta^*(q_0, 10) = \delta^*(q_0, 11)$ for any FA then strings 10 and 11 are distinguishable strings.
4. $(0^*1^*)^* = 0^*+1^*$
5. Language of strings with even number of 0's is not a regular language.
6. For each regular language, there is an equivalent NFA.
7. There is an FA correspond to each non regular language.
8. 0^n1^n for n>=0 is a regular language.
9. $P \vee \sim P$ is a tautology.
10. The relation R= {∅} on set A= {1, 2} is only symmetric relation.

[B] Draw NFA-null for following expression using KLEEN's theorem. Show the construction of NFA-null at various stages. [7]
$((00)^* + (10)^*101)(11+01)^*$

SECTION – II

Q-4 [A] Using pumping lemma for regular languages, prove that language L= $\{0^P \mid P$ is a prime$\}$ is not a regular language. [6]

[B] Design the TM for the language L ={ $a^n b^n$ | n>0 }. [6]

OR

Q-4 [A] Using pumping lemma for regular languages, prove that language L= $\{0^n 1 0^{2n} \mid n>=0\}$ is not a regular language. [6]

[B] Design the TM for the language L = $\{1^m \mid$ m is odd$\}$. [6]

Q-5 [A] Using pumping lemma for CFL, prove that L= { $a^n b^n c^n$ | n>0} is not a CFL? [6]

[B] Design the push down automata for the language L={ $N_a(x) = N_b(x) \mid x \in \{a,b\}^*$}. [5]

OR

Q-5 [A] Prove that CFL are not closed under intersection and complement operations. [6]

[B] Design the push down automata for the language L={ $wcw^r \mid w \in \{a,b\}^+$}. [5]

Q-6 [A] [6]

1. Remove the null productions from the following grammars and rewrite it.
   S→ AABD, A→ aB| AaD|^ , B→ b |bB |AbD , D→dD|d
2. Remove the unit productions from the following grammars and rewrite it.
   S → bS/A/C , A →a , B →aa , C →aCb

[B] Let a grammar is given as below: [6]
S → 0B|1A , A → 0|0S|1AA , B → 1|1S|0BB
Draw the left most derivation and right most derivation trees for the string 00110101.

End of Paper