Student Exam No._____

GANPAT UNIVERSITY

B. TECH SEM. VI COMPUTER ENGINEERING/INFORMATION TECHNOLOGY

REGULAR EXAMINATION APRIL-JUNE 2017

2CE601/2IT601: THEORY OF COMPUTATION

Time: 3 Hours **Total Marks:** 60

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION – I

Q.1 **(A)** Let G(x): x is a gold ornament, S(x): x is a silver ornament and P(x): x is precious. Translate the following logical notations into the statement. **(6)**

1. $\forall x(P(x) \rightarrow (G(x) \wedge S(x)))$
2. $\forall x((G(x) \wedge S(x)) \rightarrow P(x))$
3. $\exists x((G(x) \wedge S(x)) \rightarrow P(x))$

(B) Using principle of mathematical induction, prove that for every n>=1, $7 + 13 + 19 + \ldots + (6n+1) = n(3n+4)$. **(4)**

OR

Q.1 **(A)** Construct a relation with minimum elements on {1, 2, 3} that satisfy following properties: **(6)**

1. Reflexive, No Symmetric and No Transitive.
2. No Reflexive, No Symmetric and Transitive.

(B) Prove that the statements $(P \vee Q) \rightarrow R$ and $(P \rightarrow R) \vee (Q \rightarrow R)$ are logically equivalent. **(4)**

Q.2 **(A)** Convert NFA-null given in following figure A to corresponding NFA. Also show how to find δ^* for any state. **(6)**

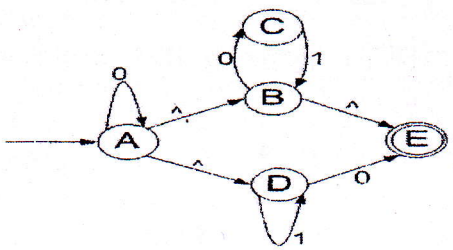


Figure A.

(B) Find a regular expression corresponding to following regular languages. Consider $\Sigma = \{0,1\}$ **(4)**

1. The language of all strings containing at least two 1's.
2. The language of all strings that does not end with 00.

OR

Q.2 **(A)** Draw an NFA corresponds to an expression $(10 + 01)^* 0$ and find $\delta^*(q_0, 10)$. Where q_0 is an initial state. **(6)**

(B) Draw a DFA corresponds to an expression $(0+1)^* 0 (0+1)$. **(4)**

Q.3 (A) Draw NFA-null for regular expression 11* (1 + 01)* 10 using KLEEN's theorem. Show the construction of NFA-null at each stage of KLEENE's theorem. (4)

(B) **State true or false for followings:** (3)

1. $0^*1^* = 0^* + 1^*$.
2. If $\delta^*(q_0, 10) = \delta^*(q_0, 11)$ for any DFA then strings 10 and 11 are distinguishable strings.
3. For expression 000111, we can draw NFA but can't draw DFA.
4. For each regular language there is an equivalent NFA.
5. P ∧ ~P is a tautology.
6. The relation R= {(1, 1)} on set A= {1, 2} is reflexive but not symmetric relation.

(C) **Match the following pairs.** (3)

A. δ function of NFA	1. $QX\Sigma \rightarrow Q$
B. P→Q	2. $QX\Sigma U\{\wedge\} \rightarrow 2^Q$
C. δ function of NFA - ^	3. $QX\Sigma \rightarrow 2^Q$
D. δ function of DFA	4. ~Q → ~P
E. ~(P→Q)	5. ~P ∨ ~Q
F. P→~Q	6. P ∧ ~Q

SECTION – II

Q.4 (A) Using pumping lemma for regular languages, prove that language $L=\{0^n11^n | n \geq 0\}$ is not a regular language. (5)

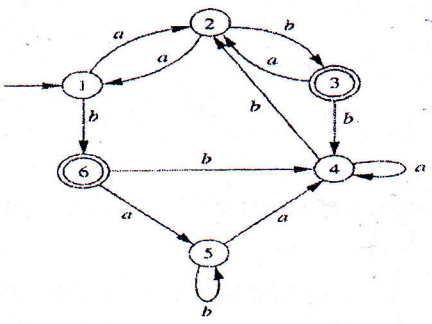
(B) Design the TM for the language L = {{a, b}* {aba} {a, b}*}. (5)

OR

Q.4 (A) Using pumping lemma for context free languages, prove that following language is not a context free language. (5)
L= {ww | w ∈ {a, b}*}.

(B) Design the TM for the language L ={ {a, b}* {aba} }. (5)

Q.5 (A) For the following DFA find a minimum state DFA recognizing the same language. (5)



(B) Explain Chomsky hierarchy of grammars in detail. (5)

OR

Q.5 (A) Write a CFG for language $L=\{0^i 1^j 0^k | j>i+k\}$. (6)

(B) Remove null productions from the following grammar and rewrite it. (4)
S→SQ | QQP | Pab | Q
P→Pa | QPa | a
Q→Pb | Qa | ^

Q.6 (A) Design the push down automata for the language $L=\{ wcw^r | w \in \{a, b\}^*\}$. (6)

(B) Write CFG equivalent to regular expression 01 (00+10)* 110*. (4)