Seat No_____

GANPAT UNIVERSITY
B.Tech. Semester VI Examination
May-June – 2012
CE601/IT601: Theory of Computation

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

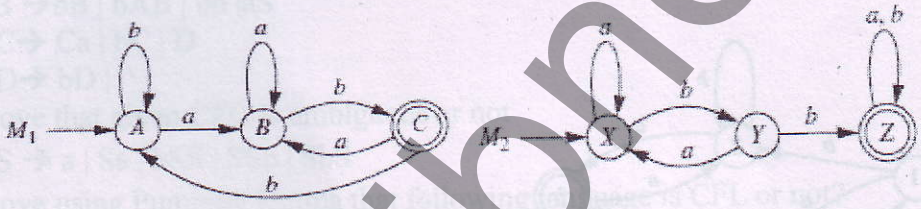
Instructions:
1. All questions are compulsory
2. Figures to the right indicate full marks.
3. Answer Both Sections in Separate Answer sheets

SECTION-I

Q-1 Answer the following questions.

[A] Let $M1$ and $M2$ be the FAs pictured below accepting languages $L1$ and $L2$, respectively. Draw FAs accepting the following languages. **[6]**

a. $L1 \cup L2$ b. $L1 \cap L2$ c. $L1 - L2$



[B] Find the regular expression on alphabet {0, 1} for following languages. **[6]**

1. The language of all strings in which number of 0's is even and the number of 1's is odd.
2. The language of all strings does not end with 01.
3. The language of all string not containing the substring 00.
4. The language of all strings in which every 0 is followed immediately by 11.
5. The language of all strings having length 6 or less.
6. The language of all string not containing the substring 000

[OR]

Q-1 Answer the following questions.

[A] Draw DFA for following Regular Expressions. **[6]**

1. (a + b)* (b+ aa) (a+b)*
2. (bbb + baa)*a

[B] Answer the following questions. **[6]**

1. If R= {(1,2),(2,1),(1,1),(2,2)} be a relation on set {1,2,3}. Of the three properties reflexivity, symmetry, transitivity determines which ones the relation R has. Give reason.
2. Prove D'Morgan Law using Venn Diagrams.
3. Write Quantified Statement for P is Prime Number.

P.T.O.

Q-2 Answer the following questions.

[A] Draw FA using KLEEN's theorem part- I for [5]

$$(a+b)^*(abba^* + (ab)^*ba)$$

[B] For a given regular expression draw NFA-Null and convert it into DFA [6]

((00*)* 1)*

[OR]

Q-2 Answer the following questions.

[A] Draw FA using KLEEN's theorem part-I for [5]

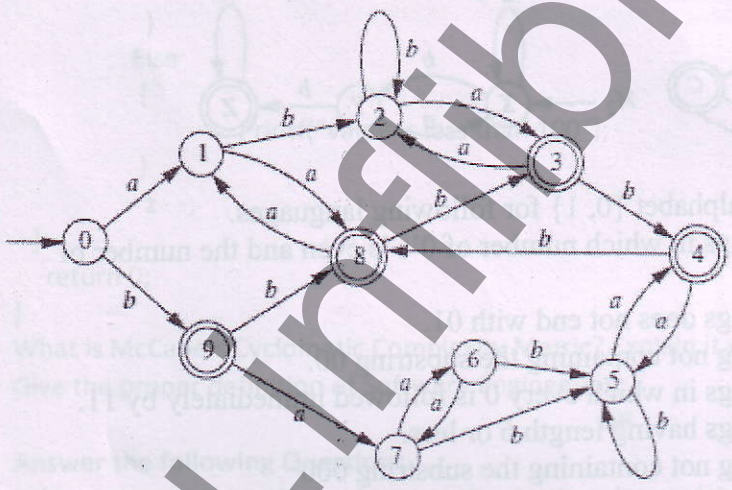
(0 +1)* (011 + 01010) (0 + 1)*

[B] For a given regular expression draw NFA-Null and convert into DFA [6]

$$(a^*bb)^* + bb^*a^*$$

Q-3 Answer the following questions.

[A] For the following FA find a minimum state FA recognizing the same language with all necessary steps. [5]



[B] Prove using PMI that for every $n \geq 0$, [4]

$$\sum_{i=0}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1}$$

[C] Let L = { ww / w ∈ {0, 1}* } show that L is regular or not using pumping lemma theorem. [3]

P.T.O

SECTION-II

Q.4 Answer the following questions.

[A] Convert given CFG to Chomsky normal form (CNF) **[6]**

$S \rightarrow TU \mid V$

$T \rightarrow aTb \mid \Lambda$

$U \rightarrow cU \mid \Lambda$

$V \rightarrow aVc \mid W$

$W \rightarrow bW \mid \Lambda$

[B] Prove that given CFG is ambiguous or not **[3]**

S → aSb | aaSb | ^

[C] Prove using Pumping lemma that following language is CFL or not? **[3]**

$L = \{ a^n b^j c^k \mid k > n \text{ and } k > j \}$

[OR]

Q.4 Answer the following questions.

[A] Convert given CFG to Chomsky normal form (CNF) **[6]**

S→ AaA | CA | BaB

A→ aaBa | CDA | aa | DC

B →bB | bAB | bb |aS

C→ Ca | bC | D

D→ bD | ^

[B] Prove that given CFG is ambiguous or not **[3]**

S → a | Sa | bSS | SSb | SbS

[C] Prove using Pumping lemma that following language is CFL or not? **[3]**

$L = \{ a^n b^j c^k \ / \ k = j*n \}$

Q-5 Answer the following question

[A] Design PDA for $\{ x \in \{a,b\}^* \ / \ N_a(x) = 2\ N_b(x) \}$. Trace for sample valid and invalid input strings. **[6]**

[B] Prove using Pumping lemma that following language is is CFL or not? **[5]**

$L = \{ WW \ / \ W \in \{a,b\}^* \}$

[OR]

Q-5 Answer the following questions.

[A] Design PDA for $\{ x \in \{a,b\}^* \ / \ N_a(x) = N_b(x) + 1 \}$. Trace for sample valid and invalid input strings. **[6]**

[B] Prove using Pumping lemma that following language is CFL or not? **[5]**

$L = \{ WW^R \ / \ W \in \{a,b\}^* \}$

Q-6 Answer the following questions.

[A] Write non deterministic PDA for given CFG. Convert Non deterministic PDA to deterministic PDA by using look aheads (LA). Trace the string for both PDA. **[6]**

S → T $

T → [T]T | ^

[B] Design Turing Machine to copy given input string. **[6]**

----------**END OF PAPER**----------