6E3018

B.Tech VIth Semester (Main/Back) Examination, June-2010

Computer Engineering

THEORY OF COMPUTATION

Time: 3 Hr **Maximum Marks: 80**

Min. Passing Marks: 24

Instruction to Condidates:

*Attempt any **five questions** selecting **one** questins from **each unit**. All questions carry **equal markis**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit–I

Q.1 (a) Suppose we restrict DFA so that they have at most one accepting state. Can any regular language L be recognized by this restricted from of DFA? Justify your answer? (8)

(b) For the following NDFA find equivalent DFA. (8)

State	Inputs	
	0	1
$\rightarrow q_0$	$\{q_0, q_1\}$	$\{q_0, q_3\}$
q_1	$\{q_2\}$	ϕ
(q_2)	ϕ	ϕ
q_3	ϕ	$\{q_4\}$
(q_4)	ϕ	ϕ

OR

Q.1 (a) Construct a Mealy machine with $\Sigma = \Delta = \{0, 1\}$. The output is 1 whenever the last four symbols read are 1111. Overlapping sequence are accepted. Output is 0 otherwise. (8)

(b) Let $\Sigma = \{a, b, c\}$ (2×4=8)

(i) Draw a DFA that rejects all words for which the last two letters match.

(ii) Draw a DFA that rejects all words for which the first two letters match.

Unit-II

Q.2 (a) Write regular expression for each of the following language over the alphabet $\{a, b\}$. (4×2=8)

(i) The set of strings containing ab as a substring.

(ii) The set of string having at most one pair of consecutive a's and at most one pair of consecutive b's.

(iii) The set of string whose length is divisible by 6.

(iv) The set of string whose 5^{th} last symbol (5^{th} symbol from the end) is b.

(b) By using pumping lemma prove that $L = \{a^{|n|} : n \geq 0\}$ is not regular. (8)

OR

Q.2 (a) Prove the following identity $(a^*ab + ba)^*a^* = (a + ab + ba)^*$. (8)

(b) Are the following true or false? Support your answer by giving proofs or counter examples: (4+4=8)

(i) If $L_1 \cup L_2$ is regular and L_1 is regular, than L_2 is regular.

(ii) If L^* is regular then L is regular.

Unit-III

Q.3 (a) Show the grammar $S \rightarrow aB/ab$, $A \rightarrow aAB/a$, $B \rightarrow ABb/b$ is ambiguous. (6)

(b) What is difference between context free language and Deterministic context free language. Give example of both language. (4)

(c) If L is context free language and R being regular then prove. (3+3=6)

(i) $L \cap R$ is context free.

(ii) $L - R = L \cap \bar{R}$ is also a context free.

OR

Q.3 (a) Find a grammar in chomsky normal form equivalent to $S \rightarrow aAbB$, $A \rightarrow aA|a$, $B \rightarrow bB|b$. (8)

(b) Let $L = \{a^i b^j c^k \mid i, j, k \geq 1 \text{ and } i + j = k\}$. Find a PDA (which accepts Via final state) that recognizes L. (8)

Unit-IV

Q.4 (a) Construct a Turing Machine over an alphabet {0, 1, #}, where 0 indicates blank, which takes a non null string of 1's and #'s and transfers the right most symbol to the left hand end. Thus ... 000 # 1 # 1000 becomes ... 0001 # 1 # 1 # 000.

The Head is initially at the leftmost non blank symbol. (8)

(b) Explain the following: (4+4=8)

(i) Subroutines

(ii) Closure properties of recursive and Recursively enumerable language.

OR

Q.4 (a) Make the comment on the following statement finite state machine with two stack is as powerful as Turing Machine. (4)

(b) Explain the following:

(i) Universal Turing Machine

(ii) Rice Theorem

(c) Design a Turing Machine that accepts $\{0^n1^n \mid n \geq 1\}$. (8)

Unit-V

Q.5 (a) Explain the model of Linear Bounded Automata.

(b) Find the grammar generating the set accepted by a linear bounded Automata M whose transition table as follows. (10)

Present state	Tape Input Symbol			
	ϕ	\$	0	1
$\rightarrow q_1$	ϕRq_1		$1Lq_2$	$0Rq_2$
q_2	ϕRq_1		$1Rq_3$	$1Lq_1$
q_3		$\$Lq_1$	$1Rq_3$	$1Rq_3$
q_4		Halt	$0Lq_4$	$0Rq_4$

OR

Q.5 Prove the following closure properties of context sensitive language: (4×4=16)

(a) Union

(b) Intersection

(c) Complementation

(d) Transpose