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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS - JUNE 2010

Course & Branch	:	**B.E.(Information Science & Engineering)**	Semester	:	**IV**
Subject	:	**Finite Automata and Formal Languages**	Max. Marks	:	**100**
Subject Code	:	**IS42**	Duration	:	**3 hrs.**

Instructions to the Candidates: Answer one full question from each unit

UNIT-I

1. a) Define the language of an NFA. (2)

   b) Define a DFA. Obtain DFA for the following languages. (8)

   (i) L={w|wε {a,b}* with atmost two consecutive b's}

   (ii) L={w| |w|mod5#0} on Σ={a}

   c) Prove that "If L=L(A) for some DFA A, then there is a regular expression R such that L=L(R)". (10)

2. a) Define Regular Expression. What does the following regular expressions represent. (10)

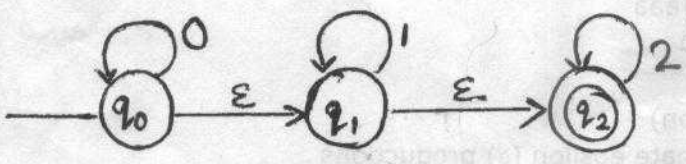
   (i) (a+b) * (ab+ba)

   (ii) (a+b)* ab(a+b)*

   (iii) ab(a+b)*

   (iv) ((a+b) (a+b))*

   b) Define ε-closure. Convert the following ε-NFA to equivalent DFA. (10)



UNIT – II

3. a) State and prove pumping lemma for regular languages. Show that the language $L=\{a^n b^n \mid n \geq o\}$ is not regular. (12)

   b) Show that the regular languages are closed under. (8)

   i) Complementation operation

   ii) Difference operation

4. a) Minimize the following DFA. (10)

	δ	0	1
→	A	B	F
	B	G	C
*	C	A	C
	D	C	G
	E	H	F
	F	C	G
	G	G	E
	H	G	C

b) Define string homomorphism with an example. (10)
Prove that "if L is a regular language over alphabet Σ, and h is a homomorphism on Σ, then h(L) is also regular".

UNIT – III

5. a) Define a CFG. Obtain CFG for the following languages. (8)
(*i*) $L=\{0^n1^n2^i \mid n\geq 1, i\geq 1\}$
(*ii*) $L=\{0^i1^n2^i \mid n\geq 1, i\geq 1\}$

b) List out any four applications of CFG. (2)

c) What do you mean by an ambiguous grammar? The grammar G=({E,I},T,P,E), where T={+,*,(,),a,b,0,1} and production E→I|E+E|E*E|(E) and I→a|b|Ia|Ib|Io|I1. Test whether the above grammar is ambiguous. If so, resole ambiguity. (10)

6. a) State and prove pumping lemma for CFL. (10)

b) Consider the following grammar (10)
S → ABC|BaB
A → aA|BaC|aaa
B → bBb|a|D
C → cA|AC
D → ε (epsilon)
   a) Eliminate epsilon (ε) productions
   b) Eliminate any unit productions in the resulting grammar
   c) Eliminate any useless symbols in resulting grammar
   d) Put the resulting grammar into CNF

UNIT – IV

7. a) Let L be a CFL and R is a regular language. Prove that the language L∩R is a CFL. (10)

b) Obtain an NPDA for the language L={WW^R|Wε(0+1)*}. Show the accessible instantaneous descriptions for the string 001100. (10)

8. a) With a neat diagram, explain the working of pushdown automata. (8)

b) Define the language acceptance of PDA. (4)
   i) By final state
   ii) By Empty stack

c) Convert the following CFG into PDA by final state. (8)
$S \rightarrow aSa|aa$
$S \rightarrow bSb|bb$

UNIT – V

9. a) Briefly explain the basic model of Turing machine with a neat diagram along with relevant terms. (8)
b) Design a Turing machine for the language $L=\{0^n1^n|n>0\}$. (8)
c) Briefly explain halting problem of Turing Machine. (4)

10 a) Prove that "Every language accepted by Multiple TM is recursively enumerable. (8)
b) Write a short notes on (12)
a) Multitape TM
b) Turing machines with semi-infinite tapes
c) Multistack TM

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