Sunny Prakash

IS42

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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)
BANGALORE – 560 054

SEMESTER END EXAMINATIONS - JUNE 2009

Course : B.E. (INFORMATION SCIENCE & ENGINEERING) **Semester: IV**
Subject Code : IS42 **Subject: Finite Automata & Formal Languages**
Maximum Marks : 100 **Duration: 3 Hours**

Instructions to the Candidates :
1. Answer one full question from each unit.
2. Any missing data may be suitably assumed.

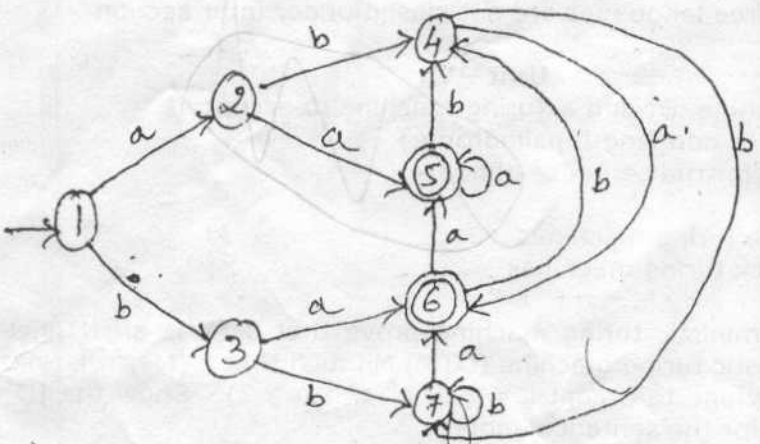
Unit - I

1. a) Define a DFA. Obtain a DFA that recognizes the language, L={W ∈ (0,1)}*: number of is 1's is even and the number 0's is a multiple of 3. (10)
   b) Write regular expressions for the following languages over ={0,1)}*. (06)
      i) Set of all strings that contain 010.
      ii) Set of all strings containing exactly three 1's.
      iii) Set of odd length strings ending in 0.
   c) Explain the applications of regular expressions. (04)

2. a) Convert the regular expression, 01*+1 to NFA with epsilon transions. Using subset construction method, convert the ε-NFA to a DFA (12)
   b) Prove that if L= L(A) for some DFA A then there is a regular expression R such that L=L(R).

Unit – II

3. a) State and prove pumping lemma for regular languages (10)
   b) Minimize the following DFA using table filling algorithm. (10)



4. a) Show that if L_1 & L_2 are regular, then so are $L_1 \cup L_2$, $\overline{L_1}$ and $L_1 \cap L_2$ (08)
   b) Show that $L=\{a^{n!} \mid n \geq 1\}$ is not regular (06)
   c) Explain homomorphism and inverse homomorphism with examples. (06)

5. a) Define context – free grammar (CFG). (10)
   Design CFG's for the following languages.
      i) $\{a^i b^j c^k \mid i=j+k\}$
      ii) {W ε (a, b)* : W is odd length string with first and last symbol begin same}

b) Consider the grammar (06)
$S \rightarrow (L) \mid a$
$L \rightarrow (L, S) \mid s$
Construct a left most derivation, right most derivation and parse tree for the sentence (a, (a,a))

c) Define left most and right most derivations. (04)

6. a) Define ambiguity in grammars. Show that the following grammar is ambiguous (06)
$S \rightarrow aS\ bS \mid bS\ aS \mid \varepsilon$

b) Explain inherently ambiguous languages with an example. (06)

c) Consider the ambiguous grammar for the language of valid expressions. (08)
$E \rightarrow E+E \mid E-E \mid E*E \mid E/E \mid (E) \mid id$
Design an unambiguous grammar and derive the sentence
$(a + b) * C - (d+e)$.

Unit – IV

7. a) Define a Push-Down Automata. Design a PDA to accept $\{WW^R : W\varepsilon (a,b)^*\}$ (14)
Trace the PDA for the word abba

b) Convert the grammar (06)
$S \rightarrow aAA$
$S \rightarrow aS \mid bS \mid a$
to a PDA that accepts the same language by empty stack.

8. a) What are useless symbol. Find a grammar equivalent to (06)
$S \rightarrow AB \mid AC$
$A \rightarrow aA \mid bAa \mid a$
$B \rightarrow bbA \mid aB \mid AB$
$C \rightarrow aCa \mid aD$
$D \rightarrow aD \mid bC$
With no useless symbols.

b) Convert the following grammar into Chomsky Normal Form (CNF) (08)
$S \rightarrow AAA/B$
$A \rightarrow aA/B$
$B \rightarrow \varepsilon$

c) Show that context free languages are not closed under inter section (06)

Unit - V

9. a) Define a turing machine. Design a Turing machine to accept (12)
$L = \{ WE (a,b)^*$; W is odd length palindrome$\}$
Trace the ;machine for the sentence abbba

b) Write a note on (08)
i) Multi tape turing machines
ii) Multi stack turing machines

10. a) Define a non deterministic turing machine prove that if M_N is an NTM, then there is a deterministic turing machine (DTM) M_D such that $L(M_N) = L(M_D)$ (10)

b) Design a turing machine to accept $L = \{ a^n b^n c^n : n \geq 2\}$. Show the ID's of the turing machine for the sentence aabbcc. (10)

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