B.Tech. – VIEP – COMPUTER SCIENCE AND ENGINEERING (BTCSVI)

Term-End Examination

00006 **December, 2014**

## BICS-018 : THEORY OF COMPUTATION

*Time : 3 hours* *Maximum Marks : 70*

Note : *Attempt any **seven** questions out of ten. All questions carry equal marks.*

1. (a) Define string alphabet and language. Write the applications of automata. *2*

   (b) Design a DFA which accepts all strings which are ending with 101 over an alphabet {0, 1}. *3*

   (c) Provide DFA recognising for
   L = {w ∈ {0, 1}* | w contains at least two 0's and at most one}. *5*

2. (a) Construct a smallest DFA over Σ = {a, b}, accepting all strings which have number of a's divisible by 6 and number of b's divisible by 8. *5*

   (b) Construct DFA and NFA for
   L = {w ∈ {0, 1}* | w contains the substring 0101}. *5*

3. (a) Define epsilon closure. Find epsilon closures of all the states of given NFA-C. Remove epsilons without changing the acceptance. *5*
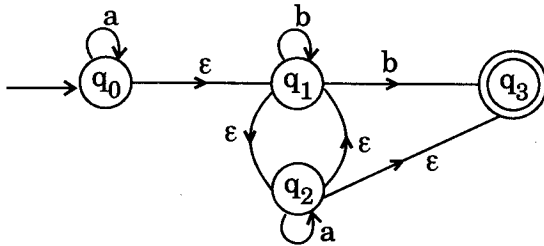
(b) For the following NFA with ε-moves, convert it into an NFA without ε-moves and show that NFA with ε-moves accepts the same language shown in figure. *5*
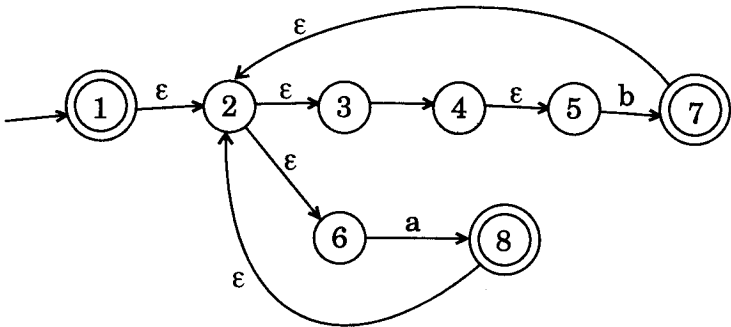
4. (a) Discuss about finite automata with outputs in representation of Moore machine and Mealy machine. *2*

(b) Design a Moore machine to determine the residue mod 4 for each binary string treated as integer. *3*

(c) Design a Mealy machine that uses its state to remember the last symbol read and emits output 'y' whenever current input matches to previous one and emits 'n' otherwise. 5

5. (a) Construct a NFA for ((01 + 10)*00)*. 5

(b) State and explain closure properties of regular sets. 5

6. (a) What is Chomsky normal form ?

Convert the following grammar to Chomsky normal form : 5

$S \rightarrow AaB \mid aaB$

$A \rightarrow \varepsilon$

$B \rightarrow bbA \mid \varepsilon$

(b) Convert the following GNF (Greibach Normal Form) 5

$S \rightarrow aA \mid B \mid C \mid a$

$A \rightarrow aB \mid \varepsilon$

$B \rightarrow aA$

$C \rightarrow cCD$

$D \rightarrow abd$

7. (a) Define deterministic pushdown automata. Explain with example. 5

(b) Convert the following context free grammar to pushdown automata : 5

$S \rightarrow aAA$

$A \rightarrow aS \mid bS \mid a$

8. (a) Design a Turing machine for

$L = \{a^n b^n c^n \mid n \geq 1\}$. 5

(b) What is recursively enumerable language ? Explain with example. 5

9. (a) Briefly explain ram machines. Give some examples. 5

(b) Write a short note on undecidability. 5

10. (a) What are NP complete and NP hard problems ? Explain with examples. 5

(b) State and explain the Hamiltonian path problem. 5

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