

I Semester M.C.A. (2 Years Course) Examination, August/September 2021
(CBCS) (2020 – 2021 and Onwards)

COMPUTER SCIENCE
1MCA4 : Theory of Computation

Time : 3 Hours

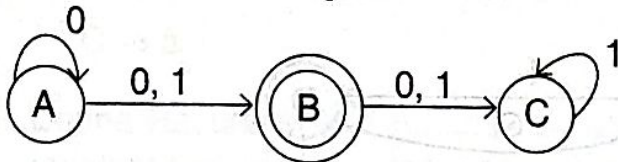
Max. Marks : 70

Instruction : Part – A : Answer any five questions.
Part – B : Answer any four questions.

PART – A

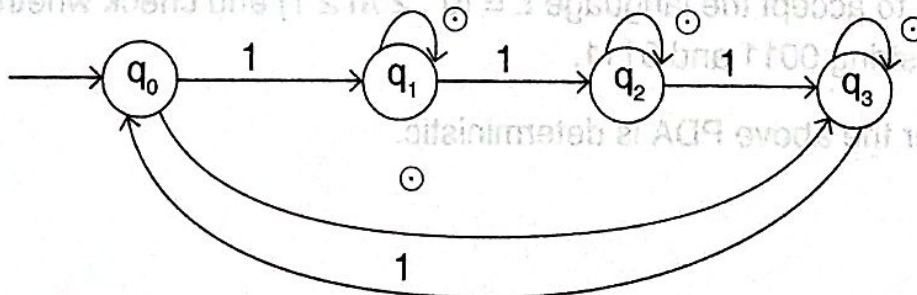
Answer any five full questions. (5x6=30)

1. Define DFA, NFA and E-NFA with examples.
2. Convert the following NFA to DFA.



3. State and prove pumping lemma for regular languages and show that $L = \{ww/w \text{ belongs to } \{a, b\}^*\}$.
4. Write the left most and right most derivation for the following production and check whether it is ambiguous.
 $S \rightarrow iCtS/iCtSeS/a$
 $C \rightarrow b.$
5. Explain with examples Chomsky hierarchy of languages.

6. Convert the following Moore Machine to an equivalent Mealy Machine.



Given $\lambda(q_0) = a,$ $\lambda(q_1) = b$
 $\lambda(q_2) = c,$ $\lambda(q_3) = d.$



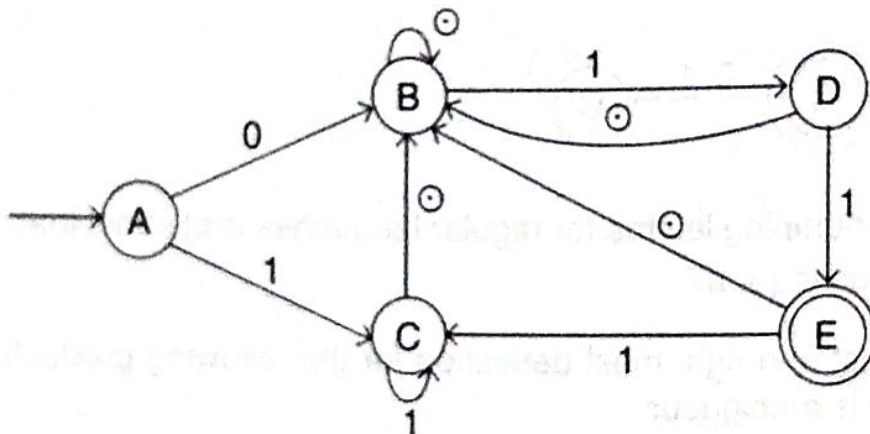
7. Explain Turing Machine and instantaneous description of Turing machine.
8. Define post correspondence problem. Check whether the lists $A = \{b, bab^3, ba\}$ and $B = \{b^3, ba, ba\}$ have a PCP solution.

PART - B

Answer any four full questions.

(4×10=40)

9. a) Design a DFA to accept strings of a's and b's starting with atleast two a's and ending with atleast two b's. 4
- b) Minimize the following DFA. 6



10. a) Construct an E-NFA for the regular expression $0(0 + 1)^* 01$. 5
- b) Prove that context free languages are closed under union, concatenation and star. 5
11. a) Design a PDA to accept the language $L = \{0^n, 2^n/n \geq 1\}$ and check whether it accepts the string 0011 and 0111. 8
- b) Check whether the above PDA is deterministic. 2



12. a) Convert the following grammar into equivalent CNF. 6
 $S \rightarrow OA/IB$
 $A \rightarrow OAA/IS/I$
 $B \rightarrow IBB/OS/O.$
- b) Define GNF and write the steps to convert CFG to GNF. 4
13. a) Write short notes on Rice theorem and Halting problem. 6
 b) Obtain a PDA for the CFG given below. 4
 $S \rightarrow aABB/aAA$
 $A \rightarrow aBB/a$
 $B \rightarrow bBB/A$
 $C \rightarrow a.$
14. Define Recursive and Recursively enumerable languages and prove that the union of two recursive languages is recursive. 10
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