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Paper Code : PCC-CS 403/PCC-CS403/PCC-CSBS401/PCCCS403 Formal Language & Automata Theory

UPID : 004423

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

    (I)   NFA, in its name has 'non-deterministic' because of _____

    (II)   The non- Kleene Star operation accepts the following string of finite length over set A = {0,1} | where string s contains even number of 0 and 1

    (III)   Language of finite automata is of which type?

    (IV)   The concept of FSA is much used in _____part of the compiler

    (V)   FSM can recognize _____

    (VI)   Consider the following language,

        $L = \{anbn | n = 1\}$

        L is_____

    (VII)   Set of regular languages over a given alphabet set is closed under_____

    (VIII)   Consider the grammar:

        S —> ABCc | Abc

        BA —> AB

        Bb —> bb

        Ab —> ab

        Aa —> aa

    Write the sentences can be derived by this grammar?

    (IX)   Consider the following grammar

        S --> Ax / By

        A --> By/Cw

        B --> x / Bw

        C--> y

    Write the regular expressions describe the same set of strings as the grammar.

    (X)   Let S = {a, b, c, d, e}. The number of strings is _____ in S* of length 4 such that no symbol is used more than once in a string

    (XI)   Given a grammar G, a production of G with a dot at some position of the right side is called _____

    (XII)   Number of states of the FSM required to simulate behaviour of a computer with a memory capable of storing "m" words, each of length 'n' is _____

Group-B (Short Answer Type Question)

Answer any three of the following :   [5 x 3 = 15]

2.   Design a DFA where every string either starts with 01 or ends with 01 over the alphabet set {0,1}.   [5]

3.   Write the regular expression for the language $L=\{a^n \mid n >0\}$.   [5]

4.   Construct an NFA for the regular expression   [5]
    $(0+1)^*00(0+1)^*$

5.   Design a PDA for the language $L = \{WcW^R \mid w \in \{a,b\}^*\}$.   [5]
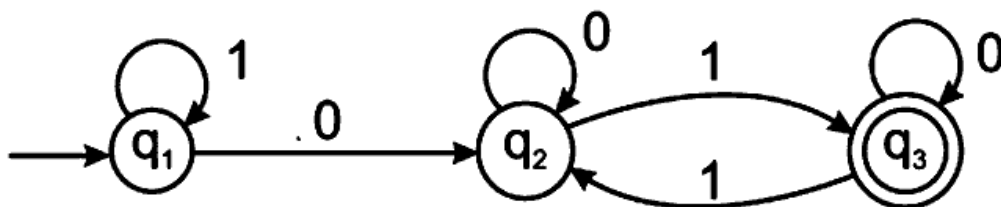
6.   Convert the following NFA to DFA.   [5]
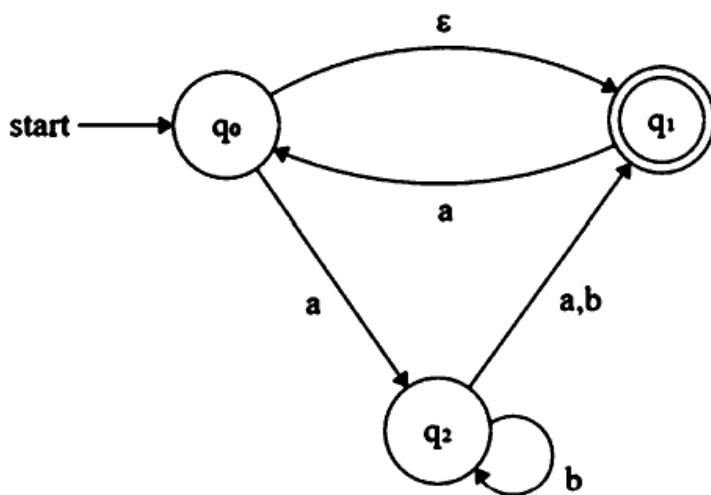
Group-C (Long Answer Type Question)

Answer any three of the following : [15 x 3 = 45]

7. (a) Design a DFA where each and every string end with '001' over the alphabet set {0,1}. [5]

   (b) Obtain the regular expression for the following DFA. [5]

   (c) Consider the following e-NFA: [5]
       Compute the e-closure of each state. Convert the NFA to DFA.

δ	∈	a	b
→	{r}	{q}	{p,r}
q	φ	{p}	φ
*r	{p,q}	{r}	{p}

8. (a) Define Chomsky normal form and convert the following CFG to CNF. [6]
       $S \rightarrow aSb|ab|Aa, A \rightarrow aab$

   (b) What is useless production? Eliminate $\in$, unit and useless production from following grammar. [9]

       $A \rightarrow bA|Bba|aa, B \rightarrow aba|b|D, C \rightarrow CA|AC|B, D \rightarrow a|\in$

9. (a) Define Deterministic PDA and Non-deterministic PDA. [6]

   (b) Construct a PDA for the grammar [9]
       $S \rightarrow aAA, A \rightarrow aS|bS|a$

10. (a) State the Pumping lemma for the Regular Language (RL). [4]

    (b) State the Pumping lemma for the Context Free Language (CFL). [4]

    (c) Prove that the given language is not regular. [7]
        $L=\{a^n b^n >=0\}$

11. Transform the CFG into GNF, given G = ({A_1,A_2,A_3}, {a,b} , P, A_1) and production P as, [15]
    $A_1 \rightarrow A_2 A_3, A_2 \rightarrow A_3 A_1|b, A_3 \rightarrow A_1 A_2|a$

*** END OF PAPER ***