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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

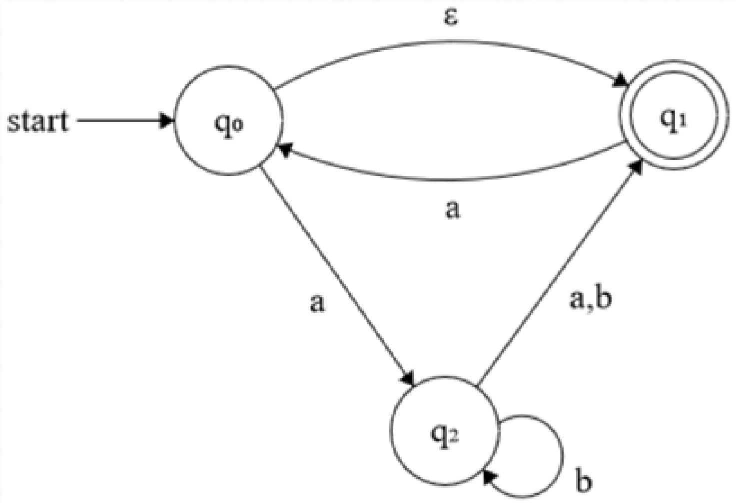
(XI) Given a grammar G, a production of G with a dot at some position of the right side is called ___________

(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 | 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 | w $\in$ $\{a,b\}^*$ }. [5]
6. Convert the following NFA to DFA. [5]

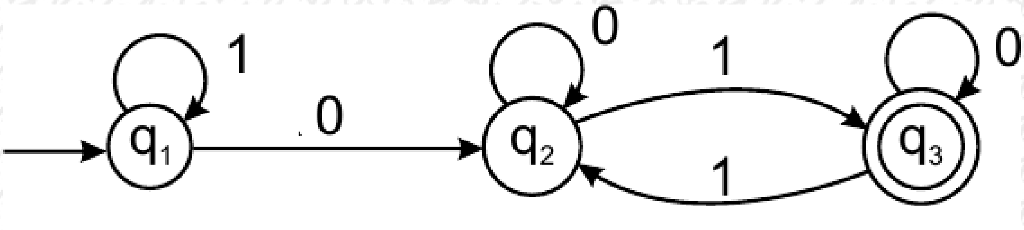


Group-C (Long Answer Type Question)

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]
$A_1 \rightarrow A_2A_3, A_2 \rightarrow A_3A_1|b, A_3 \rightarrow A_1A_2|a$

*** END OF PAPER ***