



CS/B.TECH(N)/EVEN/SEM-4/4423/2022-2023/1007

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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]

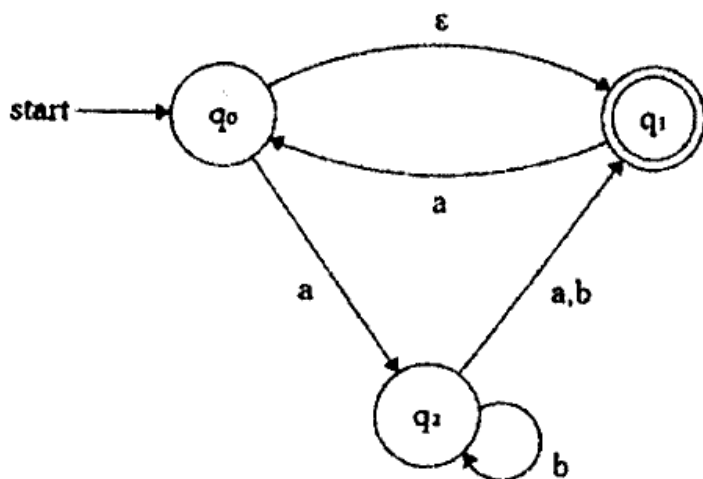
- (i) NFA, In its name has 'non-deterministic' because of _____
- (ii) The non- Kleene Star operation accepts the following string of finite length over set $A = \{0,1\}$ | where string s contains even number of 0 and 1
- (iii) Language of finite automata is of which type?
- (iv) The concept of FSA is 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:
 $S \rightarrow ABCc \mid Abc$
 $BA \rightarrow AB$
 $Bb \rightarrow bb$
 $Ab \rightarrow ab$
 $Aa \rightarrow aa$
Write the sentences can be derived by this grammar?
- (ix) Consider the following grammar
 $S \rightarrow Ax \mid By$
 $A \rightarrow By \mid Cw$
 $B \rightarrow x \mid Bw$
 $C \rightarrow y$
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 $(0 + 1)^* 00(0 + 1)^*$ [5]
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)

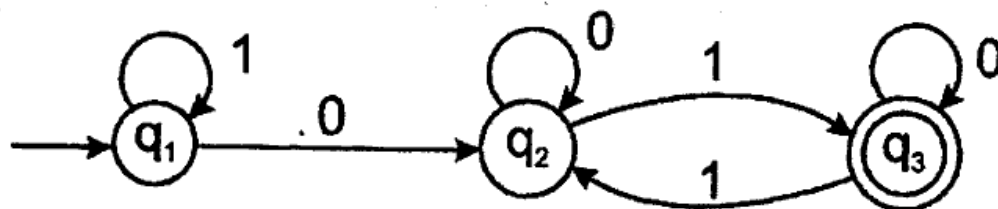
Answer any three of the following :

[15 x 3 = 45]

7. (a) Design a DFA where each and every string end with '001' over the alphabet set {0,1}.
 (b) Obtain the regular expression for the following DFA.

[5]

[5]



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

[5]

δ	ϵ	a	b
$\rightarrow p$	{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 ϵ , unit and useless production from following grammar.

[9]

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

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]

$L = \{a^n b^n \mid n \geq 0\}$

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 ***