(6 pages)

S.No. 7270 **P 22 MCAE 1 A**

(For candidates admitted from 2022–2023 onwards)

M.C.A. DEGREE EXAMINATION, NOVEMBER 2023.

Computer Applications – Elective

THEORY OF COMPUTATION

Time : Three hours Maximum : 75 marks

PART A — (20 Marks)

Answer ALL questions.

I. (A) Multiple Choice Questions: (5 × 1 = 5)

1. In the finite automaton with minimum state deterministic that accepts a given language $L = \{w \mid w\varepsilon\{0,1\}^*$, the total number of 0s as well as 1s in w that would be divisible by 3 & 5, respectively} would have:

(a) 9 states

(b) 10 states

(c) 11 states

(d) 15 states

2. If we consider an arbitrary NFA (non-deterministic finite automaton) with N states in total, the maximum number of states that are there in an equivalent DFA (minimised) is at least:

(a) N! (b) 2N

(c) 2^N (d) N^2

3. Which one of these given regular expressions isn't equivalent to this regular expression: (m + n + o) *

(a) (m*n* + o*)* (b) ((mn)*+o*)*

(c) (m*n*o*)* (d) (m*+n*+o*)*

4. Consider that we have a G ambiguous grammar along with its D disambiguated version. If the language that is recognized by these two grammars is denoted by L(G) and L(D), then which one of these would be true?

(a) $L(D) = L(G)$ (b) $L(D) \subset L(G)$

(c) $L(D)$ is empty (d) $L(D) \supset L(G)$

5. If you consider a regular expression r, in which $r = (11 + 111)^*$ over $\Sigma = \{0,1\}$, then the number of states in minimal DFA and NFA respectively are:

(a) DFA– 4, NFA – 3

(b) DFA– 3, NFA – 3

(c) DFA– 3, NFA – 4

(d) DFA– 4, NFA – 4

(B) Fill in the blanks : (5 × 1 = 5)

6. The language that a Pushdown Automation accepts in which the stack stays limited to about 10 items is described best as ————.

7. The C language is a ————.

8. Consider the language given below:

{a^mb^nC^(m+n) | m,n≥ 1}

It is a ———— language.

9. Which of these is a regular set ————?

I $\{a^n b^{2m} \mid n \geq 0, m \geq 0\}$

II $\{a^n b^m \mid n = 2m\}$

III $\{a^n b^m \mid n \neq m\}$

IV $\{xcy \mid x, y \in \{a, b\}^*\}$.

10. Consider the following languages:

$L1$ = {0^ i1^ j | i! = 2j}
$L2 \equiv$ {0^ i1^ j | i = 2j + 1}
$L2$ = {0^ i1^ j | i = j}
$L4$ = {0^ i1^ j | i! = j}

Which of these is/are context free ————.

II. Answer ALL questions. (5 × 2 = 10)

11. Define Hypothesis.

12. Differentiate L* and L+

13. What are the applications of Context free languages?

14. State the pumping lemma for CFLs.

15. Give examples of recursive languages?

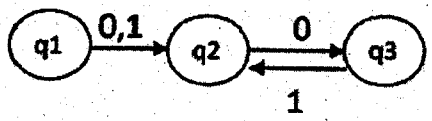
PART B — (5 × 5 = 25)

Answer ALL questions.

16. (a) Construct a NFA to accept strings of a's and b's having substring aba.

Or

(b) Convert the DFA to NFA.



17. (a) Define regular expression. Explain the applications of regular Expression.

Or

(b) State and prove the pumping lemma for regular languages.

18. (a) Obtain a CFG for the following language L={a n b n c m | n>1,m>=1}

Or

(b) Rewrite the following grammar after eliminating the useless symbols

S->AB | DS

A->a

B->c

C->D

D->Dd | ε

E->a

19. (a) Describe the LR(k) and LL(k) grammars in detail.

Or

(b) Differentiate between leftmost and rightmost derivations.

20. (a) Design PDA for odd number of palindromes.

Or

(b) State and prove the Post's correspondence problem.

PART C — (3 × 10 = 30)

Answer any THREE questions.

21. Minimize the given DFA using table filling algorithm.

$	a	b
A	B	A
B	A	C
C	D	B
D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

22. Explain in detail the closure properties of Regular languages.

23. Explain the chomsky heirarchy of grammar.

24. Explain the different types of Turing Machine. Design a turing machine that accepts the language of all strings over the alphabet $\Sigma = \{a, b\}$ whose second letter is b

25. Design Turing Machine for the language, $L = \{a^n b^n c^{"}, n >= 1\}$.