U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 19IS4PCTFC **Max Marks: 100**
Course: Theoretical Foundations of Computations **Date: 21.09.2023**

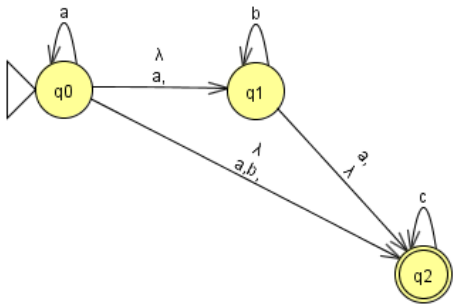
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

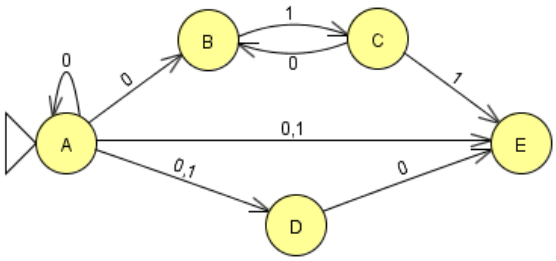
UNIT - I

1 a) Construct Deterministic Finite Automata to **09**
i. Accept strings of a's and b's having exactly one 'a'.
ii. Accept strings of 0's and 1's having 3 consecutive 0's
iii. Accept strings which belong to the language L={w | |w| mod 3=0 and ∑={0,1}}

b) Define Ɛ-Closure. Give the Ɛ-Closure of all the states in the given automaton. **03**



c) Convert the following NFA to DFA **08**

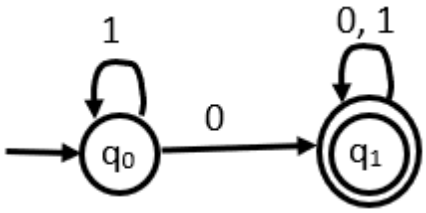


UNIT - II

2 a) Develop the Regular Expression for the following: **10**
i. To accept strings of the language L={$a^n b^m$ | m+n is even}
ii. To accept strings of the language L={$a^n b^m$ | n≥4 and m≤3}
iii. To accept strings of 0's and 1's containing not more than three a's.
iv. To accept strings of the language L={ w | w contains 010 as a substring for Σ ={ 0,1}}

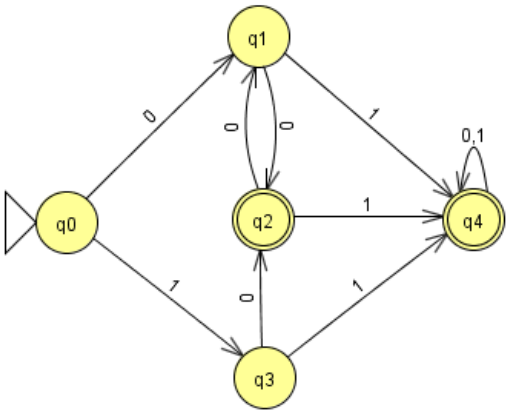
b) Show that the language L={$a^{n!}$ | n≥0 } is not regular. **06**

c) Deduce regular expression for the finite automata using Kleene's theorem. **04**

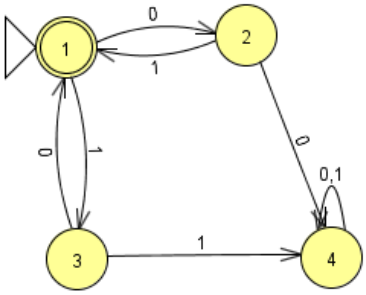


OR

3 a) Minimize the following DFA using Table filling algorithm **08**



b) Obtain a Regular Expression for the Finite Automata given below **08**



c) Obtain ε-NFA from the regular expression **ab(a+b)*** **04**

UNIT - III

4 a) Define Context Free Grammar (CFG). Design CFG for the following languages and show derivation of the respective string: **10**

i. Language of all palindromes over ∑={a,b} and derive the string "abba"

ii. L={a^nb^n | n>=0 } and derive the string "aabb"

iii. Language consisting of strings even no. of a's with ∑={a} and derive the string "aaaa"

b) Eliminate the NULL production and Unit production from the grammar given below **10**

S → AB | ABC
A → BA | BC | Ɛ | a
B → AC | CB | Ɛ | b
C → BC | AB | A | c

OR

5 a) Define ambiguous grammar. Identify if the below given grammar is ambiguous for the string "id+id*id": **05**

E → E+E
E → E-E
E →E*E
E →E/E
E → id

b) Convert the below given grammar to CNF: **10**

S → aA | a | B | C
A → aB | Ɛ
B → aA
C → cCD
D → abd

c) Convert the following grammar to GNF: **05**

S → AA | 0
A → SS | 1

UNIT - IV

6 a) Design Push Down Automata to accept by final state for the language L= {w Є (a,b)* | $n_a(w) = n_b(w)$}. Check whether the PDA is deterministic or not. Give instantaneous description for the string "aabbab" **10**

b) Describe the algorithm to convert CFG to PDA. Using the same, convert the below grammar to PDA. Test whether "aabbbb" is acceptable by this PDA. **10**

S-> aABB | aAA
A-> aBB|a
B-> bBB | b
C-> a

UNIT - V

7 a) Design Turing Machine to accept the language L= {ww^R | w Є (a,b)*}. Provide instantaneous description for acceptance of the string "abba". **12**

b) Describe the following with an example: **08**

i. Post Correspondence problem
ii. Decidable and Un-decidable language

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