R20 Regulation *Subject code:3P3HC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech III Semester Regular/Supplementary Examinations, March/April 2023

FORMAL LANGUAGES & AUTOMATA THEORY

(CSE(DATA SCIENCE))

Maximum Marks: 70 Date:01.04.2023 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

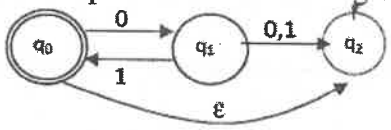
All the following questions carry equal marks (10x2M=20 Marks)

1 Define NFA with ∈- moves.
2 What is Kleene Closure and Positive Closure?
3 Write the regular expressions for the language of Strings with three consecutive 1's over the alphabet 'Σ = {0, 1} .
4 How do you prove a language is regular?
5 Define Context Free Grammar.
6 Define push down automata.
7 What are the components of a Turing Machine?
8 How is a two stack PDA equivalent to a Turing machine?
9 Define unrestricted grammar?
10 Why is the halting problem undecidable?

Part-B

Answer All the following questions. (5X10M=50Marks)

11 Discuss the Mathematical representation of Finite State Machine FSM? Construct a DFA equivalent to the NFA given below

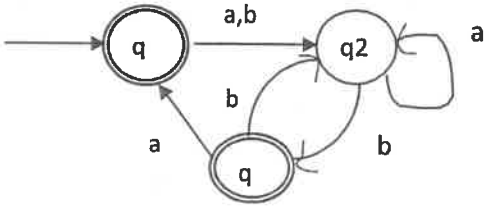


(10M)

OR

12 A. Give a DFA for Σ = {a, b} that accepts any string with *aababb* as a substring. (5M)
B. Define Moore Machine. Design a Moore machine for 2's complement of binary number. (5M)

13 A. Convert the following DFA to a regular expression.



(7M)

B. Explain about the identity rules of Regular Expressions? (3M)

OR

14 A. Explain about Algorithm for minimizing DFA? (4M)

B. Construct Minimum state Automata for the following DFA ? (6M)

* denotes final state

δ	0	1
→ q1	q2	q3
q 2	q3	q5
*q 3	q4	q3
q 4	q3	q5
*q5	q2	q5

15 A. Define PDA. Construct a PDA that accepts language (6M)

$L = \{ ww^R \mid w = (a+b)^* \}$.

B. Differentiate between Deterministic PDA and Non-deterministic PDA. (4M)

OR

16 A. Define Ambiguous Grammar? Check whether the grammar

E->E+E,E->E*E, E->id Is Ambiguous or not string:id+id*id? (5M)

B. Construct Left most derivation for the string aabbaaa? The Grammar is (5M)

{S→AS|a, A→SbA|SS|ba}

17 A. State and Explain the closure properties of CFG.

B. Consider the CFG with {S,A,B} as the non-terminal alphabet, {a,b, ε} as the terminal alphabet, S as the start symbol and the following set of production rules (4M) (6M)

S→ASA | aB

A→B|SB→b|ε

Convert the given grammar into CNF

OR

18 Define Turing Machine. Construct a Turing Machine for language (10M)

$L = \{0^n1^n2^n \mid n \geq 1\}$.

19 A. Define Post Correspondence Problem? Explain in brief about PCP with an example? (6M)

B. Explain about recursive and recursively enumerable language. (4M)

OR

20 Explain in detail about P, NP, NP-complete and NP-hard problems with realtime examples for each. (10M)