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Subject Code:- ACSBS0306

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: III - THEORY EXAMINATION (2021 - 2022)

Subject: Formal Language & Automata Theory

Time: 03:00 Hours

Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises of three Sections A, B and C.

- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - I questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type - II questions carrying 10 marks each.
- No sheet should be left blank. Any written material after a Blank sheet will not be evaluated/checked.

SECTION A

20

1. Attempt all parts:-

1-a. Finite Automata has 1

1. Unlimited memory
2. No memory at all
3. Limited Memory
4. None of these

1-b. A language L is accepted by a FSM iif it is 1

1. CFL
2. CSL
3. Recursive
4. Regular

1-c. Grammar is defined by number of _____tuples 1

1. 4
2. 5
3. 3
4. 2

1-d. More than one Parse tree can be generated from a same sentence. The Grammar which has this property are known as: 1

1. Ambiguous
2. Unambiguous
3. Ambiguous and Unambiguous
4. Intersection

1-e. Turing machine is more powerful than FSM because 1

1. Tape movement is confined to one direction only
2. It has no finite state control
3. It has the capability to remember arbitrary long sequence of input symbols
4. None of these

1-f. Turing machine was invented in _____ by Alan Turing. 1

1. 1938
2. 1936
3. 1836
4. 1838

1-g. If every string of a language can be determined, whether it is legal or illegal in finite time, the language is called 1

1. Non-deterministic
2. Deterministic
3. Undecidable
4. Decidable

1-h. Halting problem is an example for? 1

1. Decidable problem
2. undecidable problem
3. complete problem
4. traceable problem

1-i. What does NP stands for in complexity classes' theory? 1

1. Non polynomial
2. Non-deterministic polynomial
3. Both (a) and (b)
4. None of the mentioned

1-j. Which of the following are the examples of NP-complete Problem 1

1. Knapsack problem
2. Hamiltonian path problem.
3. Subset sum problem.
4. All of above

2. Attempt all parts:-

2-a. Differentiate between Kleene and Positive Closure. 2

2-b. Given Grammar Production generate the string for it 2

$S \rightarrow abS \mid a$

2-c. Differentiate between PDA and Turing machine. 2

2-d. Define post correspondence problem. 2

2-e. Describe the importance of NP-Complete problems. 2

SECTION B 30

3. Answer any five of the following:-

3-a.	Construct a DFA with reduced states equivalent to regular expression 10+(0+11)0*1	6
3-b.	Define all tuples for a grammar.	6
3-c.	Correspondence between PDA and CFG. Justify the statement.	6
3-d.	Prove that every language accepted by PDA by final state is also accepted by same PDA by empty store	6
3-e.	Write short note on Church Turing Thesis.	6
3-f.	Find whether the lists M = (ab, bab, bbaaa) and N = (a, ba, bab) have a Post Correspondence Solution?	6
3-g.	Prove that 3-SAT is NP-complete.	6

SECTION C 50

4. Answer any one of the following:-

4-a.	Discuss Chomsky's Hierarchy of formal languages.Explain briefly about DFA and NFA?	10
4-b.	Find all strings of length 5 or less in the regular set represented by the following regular expressions: a) (ab+a)*(aa + b) b) (a*b + b*a)*a c) a* +(ab +a)*	10

5. Answer any one of the following:-

5-a.	Compare Deterministic and Non deterministic PDA. Is it true that non deterministic PDA is more powerful than that of deterministic PDA? Justify your answer.	10
5-b.	Convert the following PDA into an equivalent CFG. δ (q0,a0,z0)→(q1,z1z0) δ(q0,b,z0)→(q1,z2z0) δ(q1,a,z1)→(q1, z1z1) δ(q1,b,z1)→(q1, λ) δ(q1,b,z2)→(q1,z2z2) δ(q1,a,z2)→(q1, λ) δ(q1, λ,z2)→(q1, λ) accepted by the empty stack.	10

6. Answer any one of the following:-

6-a.	Define Turing Machine and explain transition tables and transition diagrams? Design a Turing Machine to accept the language L = {W W^R W $\in$(a+b)}	10
6-b.	Explain the halting problem in details.	10

7. Answer any one of the following:-

7-a.	Define the recursive languages. Do you agree that every recursive language is recursively enumerable languages. Justify your answer.	10
7-b.	Explain the Rice theorem and its relevance with Turing Machine.	10

8. Answer any one of the following:-

8-a.	Write the non-deterministic sorting algorithm and also analyze its complexity?	10
8-b.	Briefly explain the classes NP-hard and NP-complete?	10