Printed Page:- 05 **Subject Code**:- **ACSBS0306**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - AUGUST 2023

Subject: Formal Language & Automata Theory

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *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 (CO1) 1

(a) Unlimited memory

(b) No memory at all

(c) Limited Memory

(d) None of these

1-b. If Σ={a} then Σ* - Σ+ is: (CO1) 1

(a) {aa}

(b) {a}

(c) {a,aa,aaa,___ _ _}

(d) {Null}

1-c. Type-3 grammars generate _____languages.(CO2) 1

(a) Regular

(b) context-free

(c) context-sensitive

(d) All of above

1-d. A grammar that produces more than one parse tree for the same sentence is called _____ . (CO2) 1

(a) Contiguous

(b) Ambiguous

(c) Unambiguous

(d) Regular

1-e. According to Church's thesis : (CO3) 1

(a) Anything done by the FSM can be easily done by Turing Machine

(b) Anything done by the digital computer can be easily done by PDA

(c) Any real-world computation can be translated into an equivalent computation involving a Turing Machine.

(d) None of these

1-f. A Turing Machine can always move Left or _____. (CO3) 1

(a) Right

(b) Shift

(c) Up

(d) Down

1-g. Which of the following statements are correct?(CO4) 1

(a) A language 'L' is decidable if it is recursive language.

(b) A language 'L' is decidable if it is recursive enumerable language.

(c) A language 'L' is undecidable if it is recursive language.

(d) A language 'L' is not undecidable if it is recursive enumerable language.

1-h. Undecidable problems are unsolvable. This statement is _____ . (CO4) 1

(a) TRUE

(b) FALSE

(c) Canot say

(d) sometimes true

1-i. Which of the following is true about NP-Complete and NP-Hard problems.(CO5) 1

(a) If we want to prove that a problem X is NP-Hard, we take a known NP-Hard problem Y and reduce Y to X

(b) The first problem that was proved as NP-complete was the circuit satisfiability problem.

(c) NP-complete is a subset of NP Hard

(d) All of the above

1-j. Which of the following are the examples of NP-complete Problem. (CO5) 1

(a) Knapsack problem

(b) Hamiltonian path problem.

(c) Subset sum problem.

(d) All of above

2. Attempt all parts:-

2.a. Explain the transition diagram for deterministic finite automata in brief. (CO1) 2

2.b. Define Pushdown Automata . (CO2) 2

2.c. Differentiate between Multi- Tape and Multi-Track Turing machine. (CO3) 2

2.d. What are UTMs or Universal Turing machines? (CO4) 2

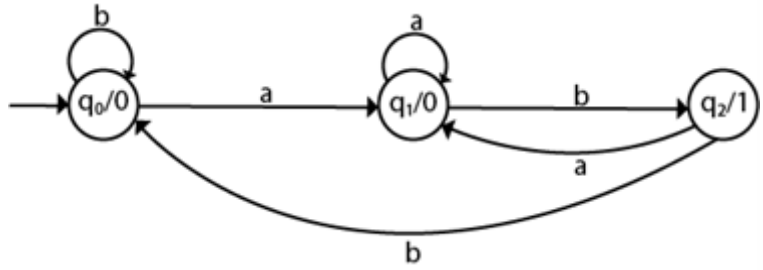
2.e. Define NP problems. (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. State Pumping Lemma and prove that L={a^n I n is a perfect square} is not regular (CO1) 6

3-b. Convert the given Moore machine into its equivalent Mealy machine. (CO1) 6



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3-c. Construct the PDA for the L= {a^n c b^{2n} n≥1} Over the alphabet ∑= {a, b, c} (CO2) 6

3-d. Explain Left & Right derivations and Left & Right derivation trees with examples. (CO2) 6

3.e. Arrange in descending order for the finite automaton, linear bounded automata ,pushdown automaton and Turing machine according to their power and signify the importance of it. (CO3) 6

3.f. Explain the Decidable Problems with examples. (CO4) 6

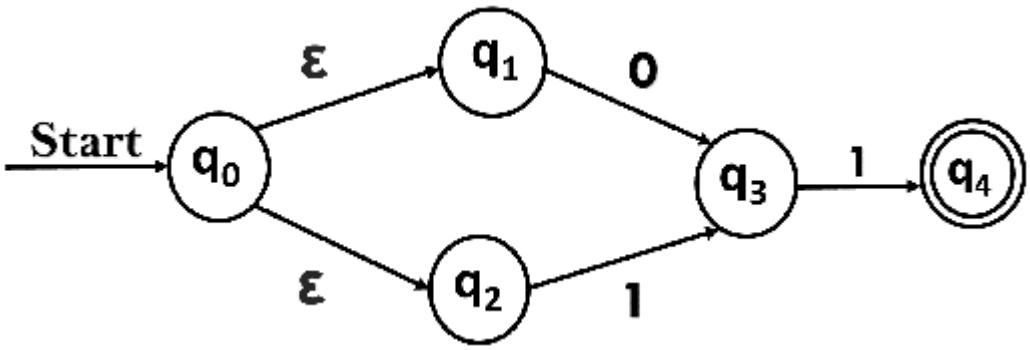
3.g. Prove Cook Leven Theorem. (CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. Define Grammar? What are the tuples?Illustrate with an example. (CO1) 10

4-b. Convert the given NFA into its equivalent DFA. (CO1) 10



5. Answer any <u>one</u> of the following:-

5-a. Construct a PDA which recognizes all strings that contain equal number of 0's and 1's. (CO2) 10

5-b. Explain about derivation and parse trees. (CO2) 10

(i) Construct the string 0100110 from the Leftmost and Rightmost derivation.

S → 0S/1AA
A → 0/1A/0B
B → 1/0BB

(ii) Find the parse tree for generating the string 11001010 from the given grammar.

S → 1B/0A
A → 1/1S/0AA
B → 0/0S/1BB

6. Answer any <u>one</u> of the following:-

6-a. If L and L' are both recursively enumerable. Show that L and L' are recursive. (CO3) 10

6-b. Write short note on: (CO3) 10

i) Recursive Language and Recursively Enumerable Language.
ii) PCP problem and Modified PCP Problem

7. Answer any <u>one</u> of the following:-

7-a. How turing machine can be converted into Universal turing machines? (CO4) 10

7-b. Define the recursive languages. Do you agree that every recursive language is recursively enumerable languages. Justify your answer. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. Describe deterministic and nondeterministic Turing machines. Explain the time complexity of deterministic and nondeterministic Turing machines also. (CO5) 10

8-b. Explain the relationship between class P, NP, NP-complete and NP hard problem with example of each class. (CO5) 10