Printed Page:- 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 - CARRY OVER THEORY EXAMINATION - JUNE (2021 - 2022)

Subject: Formal Language & Automata Theory

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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 Finite Automata has (CO1) 1

(a) Unlimited memory
(b) No memory at all
(c) Limited Memory
(d) None of these

1 Chomsky Hieararchy is categorized in how many categories (CO1) 1

(a) 3
(b) 2
(c) 1
(d) 4

1-c. Which of the following does not belong to CFG ? (CO2) 1

(a) Terminal Symbol
(b) End Symbol
(c) Start symbol
(d) Non Terminal

1-d. Type-3 grammars generate ____________languages.(CO2) 1

(a) Regular
(b) context-free
(c) context-sensitive
(d) All of above

1-e. Universal Turing machine influenced the concept of (CO3) 1

(a) Stored program computers
(b) Interpretive implementation of programming language
(c) Computability
(d) All of these

1-f. Turing machine was invented in ______________________ by Alan Turing.(CO3) 1

(a) 1938
(b) 1936
(c) 1836
(d) 1838

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. Halting problem is an example for? (CO4) 1

(a) Decidable problem
(b) undecidable problem
(c) complete problem
(d) traceable problem

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. (C05) 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. | Write short note on Universal Turing Machine. (C03) | 2 |
| 2.d. | Define post correspondence problem. (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={$a^n$ \| n is a perfect square} is not regular (CO1) | 6 |
| 3-b. | Explain parse tree in detail. (CO1) | 6 |
| 3-c. | Define ambiguity.? Show that the grammar with following production is ambiguous.<br>$A \rightarrow AA \mid (A)$ (C02) | 6 |
| 3-d. | Correspondence between PDA and CFG. Justify the statement. (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. | Find whether the lists M = (ab, bab, bbaaa) and N = (a, ba, bab) have a Post Correspondence Solution? (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. | Find all strings of length 5 or less in the regular set represented by the following regular expressions:<br>a) (ab+a)*(aa + b) | 10 |

b) (a*b + b*a)*a
c) a* +(ab +a)*  (CO1)

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

| | | |
|---|---|---|
| 5-a. | Write the steps to convert CFG to GNF form. (CO2) | 10 |
| 5-b. | Construct a PDA which recognizes all strings that contain equal number of 0's and 1's (C02) | 10 |

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. | Define a Turing Machine. With a neat diagram explain the working of a Turing Machine. (CO3) | 10 |

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

| | | |
|---|---|---|
| 7-a. | Define the recursive languages. Do you agree that every recursive language is recursively enumerable languages. Justify your answer. (CO4) | 10 |
| 7-b. | Explain the Rice theorem and its relevance with Turing Machine. (CO4) | 10 |

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

| | | |
|---|---|---|
| 8-a. | Compare and contrast Tautology and SAT. (CO5) | 10 |
| 8-b. | How to show that a problem does/does not have any solution? efficient algorithm? (CO5) | 10 |