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PES UNIVERSITY, Bangalore

(Established under Karnataka Act No. 16 of 2013) **UE19CS205**

IN SEMESTER ASSESSMENT (ISA-2)- B.TECH III SEMESTER
November, 2020

SAMPLE QUESTION PAPER

Automata Formal Languages & Logic

Time: 1 $\frac{1}{2}$ Hrs **Answer All Questions** **Max Marks: 40**

Note:

- **Read all the Questions carefully before answering.**
- **The Question paper spans over 3 sheets and contains 4 Questions.**

1	a	Construct a Turing Machine for any one of the given questions. **(You have a Choice in this question)** 1) We wish to build a shifting machine S with the following specification, where u and w are strings that do not contain any □'s: Input: □u□w□ Output: □uw□ uw Example: Input: □11□00□ Output: □1100□ **OR** 2) Construct a Turing machine which, given an input 1^n leaves 1^{3n+1} on the input tape.	5
	b	Consider the language L = {w = xy : x, y {a, b}* and y is identical to x except that each character is duplicated}. For example **abab**aabbaabb ∈ L. Prove using Pumping lemma that L is not context-free. (Note : Clearly specify all the cases)	5
2	a	a) Which of the following is a Deterministic Context Free Language? Justify your answer. i) $\{0^n1^m0^m1^n \mid n,m > 0\}$ ii) The set of all strings $0^i1^j0^k$ where either i = j+k or k = i+j. b) Describe algorithms to decide whether a given Deterministic Pushdown Automaton generate (0+1)*?	5

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	b	Are the given problems recursive or recursively enumerable or Non-RE. Justify your answer. (a) L= {<M>|M is a TM, and |M | < 1000}. (b) A useless state in a Turing machine is one that is never entered on any input string. Consider the problem of determining whether a Turing machine has any useless states.	5 (2+3)
3	a	Given the following premises (1) (sunny ∧ warm) → enjoy (2) (warm ∧ pleasant) → strawberry_picking (3) raining → ~strawberry_picking (4) raining → wet (5) warm (6) raining (7) sunny Prove using resolution refutation the following: I. **(you will enjoy)** conclusion : enjoy II. **(You are not doing strawberry picking)** conclusion : ~strawberry_picking	5
	b	Determine whether each of the following are valid, satisfiable (but not valid), or unsatisfiable. 1. (rich ⇒ happy) ∧ rich ∧ ¬happy 2. (rich ⇒ happy) ∧ rich ∧ unhappy	5
4	a	Assume you would like to represent the domain of a World map **or** Computer Networks using the Predicate logic. **[Pick only one domain]**Answer the following : 1. Determine and specify a minimum of 5 objects in the domain. 2. Specify a minimum of 5 relations among the objects identified. 3. Specify a minimum of 2 functions. Note : Specify the relations and functions in proper syntax. The input and output of each function must be clearly mentioned.	5

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	b	Consider the universe to be the set of integers, *E(x)* represents *x* is even, and *O(x)*, *x* is odd. Translate the given sentences in Predicate logic to natural language: 1) $\exists\, x\, E(x) \wedge \exists\, x\, O(x)$ 2) $\forall\, x \neg E(x)$ 3) $\forall\, x\, [\neg E(x) \rightarrow O(x)]$ 4) $E(2)$	5

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