Assignment
Course Title: Theory of Computation (CSTE-2107)
(Written: 15+ Viva: 10= Total: 25)

Instructions:

1. A report from each student.
2. The report should be hand-written (Please write on both sides of a page just to reduce paper wastage)
3. Submit the soft-copy of it by the 10/07/2023 into the class-room **(Sharp deadline, no further extension)** and the hard copy of it by 17/07/2023 (you can deposit it to the CSTE office in case of my unavailability).
4. Viva will be held after your final exam. The date will be announced later. (Syllabus from Lecture-15 to Lecture-21)

Student ID	Assigned Questions to Answer
1,5,9,13,17,21,25,29,33, 37, 41, 45, 49, 2001041	1. Write down the formal notations for PDAs. **(3)** 2. Write short notes on: P, NP, NP-hard, NP-completeness classes. **(3)** 3. Draw a turing machine for the language $L = \{a^n b^n c^n \mid n>=0\}$. **(4)** 4. Consider the following grammar: **(5)** $S \rightarrow 0A0 \mid 1B1 \mid BB$ $A \rightarrow C$ $B \rightarrow S \mid A$ $C \rightarrow S \mid \varepsilon$ (i) Eliminate ε-productions. (ii) Eliminate any unit-productions in the resulting grammar. (iii) Eliminate any useless symbols in the resulting grammar. (iv) Put the grammar into Chomsky Normal Form.
2,6,10,14,18,22,26,30, 34,38,42,46,50	1. Illustrate non-deterministic turing machine. Prove that "Every multitape turing machine has an equivalent single tape turing machine". **(3)** 2. Draw a PDA for the language $L=\{a^n b^n \mid n>=0\}$. **(4)** 3. Show the coding rules for the universal turing machine? Differentiate between recursive language and recursively enumerable language. **(3)** 4. Consider the following grammar: **(5)** $S \rightarrow ASB \mid \varepsilon$ $A \rightarrow aAS \mid a$ $B \rightarrow SbS \mid A \mid 20bb$ (i) Eliminate ε-productions. (ii) Eliminate any unit-productions in the resulting grammar. (iii) Eliminate any useless symbols in the resulting grammar. (iv) Put the grammar into Chomsky Normal Form.
3,7,11,15,19,23,27,31, 35,39,43,47,2001022	1. Write down the formal notations for turing machine. **(3)** 2. Design a PDA to accept a language $L = \{a^i b^j c^k \mid i, j, k \geq 0$ **and** $i = k$ **or** $j = k\}$. **(4)** 3. What is the halting problem and the post correspondence problem? Why they are known as undecidable problems? Explain. **(3)** 4. Consider the following grammar: **(5)** $S \rightarrow AAA \mid B$ $A \rightarrow aA \mid B$ $B \rightarrow \varepsilon$ (i) Eliminate ε-productions. (ii) Eliminate any unit-productions in the resulting grammar.

	(iii) Eliminate any useless symbols in the resulting grammar. (iv) Put the grammar into Chomsky Normal Form.
4,8,12,16,20,24,28,32,36, 40,44,48,2001037	1. Design a turing machine for computing a function $f(x,y) = x + y$. **(4)** 2. What do you mean by diagonalization language? Explain about polynomial time reducibility. **(3)** 3. Define Greibach Normal Form (GNF). Eliminate left recursion from the following grammar: **(3)** $S \rightarrow S0S1S \mid 01$ 4. Consider the following grammar: **(5)** $S \rightarrow aAa \mid bBb \mid \varepsilon$ $A \rightarrow C \mid a$ $B \rightarrow C \mid b$ $C \rightarrow CDE \mid \varepsilon$ $D \rightarrow A \mid B \mid ab$ (i) Eliminate ε-productions (ii) Eliminate any unit-productions in the resulting grammar. (iii) Eliminate any useless symbols in the resulting grammar. (iv) Put the grammar into Chomsky Normal Form.

Regards,

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