



United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam Summer 2022

CSE 2233/CSI 233: Theory of Computation/Theory of Computing

Total Marks: 40

Duration: 120 Minutes

Answer all questions. Figures in the right-hand margin indicates full marks.

Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.

1.	Consider the following context-free grammars (CFG). With the help of Top-Down Parse Tree decide whether the grammars are ambiguous or not: a) $S \rightarrow 2BA \mid 1S \mid 2A$ $B \rightarrow 1B3 \mid 1S3 \mid \epsilon$ $A \rightarrow A11 \mid 12AS3 \mid B \mid \epsilon$ b) $B \rightarrow 11BS \mid 0S0B \mid \epsilon$ $S \rightarrow AC01 \mid 0S \mid 1S \mid A1$ $A \rightarrow 1 \mid B \mid CA \mid \epsilon$ $C \rightarrow x \mid y \mid A$ 211211313 011010	3 x 2
2.	Find a CFG that generates the following languages. a) $L = \{a^m b^n c^{3n} d^{2m} \mid \text{where } m, n \geq 1\}$ b) $L = \{X^i Y^j Z^k \mid \text{where } i=k \text{ or } j=k \text{ and } i, j, k \geq 0\}$ c) $L = \{w \text{ is consisted of } \{0,1\} \mid w \text{ is odd and mid symbol is } 0\}$	2 x 3
3.	Convert the following CFGs into the equivalent Chomsky Normal Form (CNF) [Show all the Steps] a) $A \rightarrow 1 \mid B \mid CA \mid \epsilon$ $B \rightarrow 1BS \mid 0S0B \mid \epsilon$ $C \rightarrow x \mid y \mid A$ $S \rightarrow 1A1 \mid 0S \mid S \mid A1$ b) $W \rightarrow 2XY \mid 1W \mid 2Y$ $X \rightarrow 1X3 \mid 1W3 \mid \epsilon$ $Y \rightarrow Y11 \mid 12YW3 \mid X \mid \epsilon$	4 x 2

4.	<p>a) Draw Push Down Automata (PDA) for the Language $L = \{a^m b^n c^k \mid \text{where } k=m-n \text{ and } m \geq 1 \text{ and } n \geq 1\}$</p> <p>b) Draw Push Down Automata (PDA) for the Language $L = \{W \text{ which is an Odd Palindrome where } W \in \{0, 1\}^*\}$</p>	5 + 5
5.	<p>Draw Turing Machine for the following Language and Show the Tape Traversal for the Given input</p> <p>a) $L = \{a^m b^n c^k \mid \text{where } m = \frac{k}{n} \text{ and } m, n, k \geq 1\}$ Input String: aabbcccccc</p> <p>b) $L = \{W \# W^R \mid W \in \{x, y\}^*\}$ and W^R is the reverse string of W Input String: xyy#yyx</p>	5 x 2