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 → 2BA | 1S | 2A **211211313** B → 1B3 | 1S3 | ε A → A11 |12AS3 | B | ε **b)** B→ 11BS | 0S0B | ε **011010** S→ AC01 | 0S | 1S | A1 A→ 1 | B | CA | ε C→ x| y |A	3 x 2
2.	Find a CFG that generates the following languages. a) L = $\{a^m b^n c^{3n} d^{2m} \mid$ where m,n>=1$\}$ b) L = $\{x^i y^j z^k \mid$ where i=k or j=k and i, j, k >=0$\}$ c) L = {w is consisted of {0,1} | |w| 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→ 1 | B | CA | Є B→ 1BS | 0S0B | ε C→ x| y |A S→ 1A1 | 0S | S | A1 b) W → 2XY | 1W | 2Y X → 1X3 | 1W3 | ε Y → Y11 |12YW3 | X | ε	4 x 2

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