United International University (UIU)
Dept. of Computer Science & Engineering (CSE)

Mid Exam Spring 2022.

CSE 2233/CSI 233: Theory of Computation/Theory of Computing
Total Marks: **30**   Duration: 105 Minutes

Answer all questions. Figures are 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.	Design DFAs that accepts the following languages:	3x3
	a) L= starts with '0' *and* contains '110' *and* ends with '01' | $\sum = \{0,1,2\}$	
	Sample Valid: 011001, 001101 *Sample Invalid: 111001, 0110100*	
	b) L= starts with 'c' *and* contains 'abc' or 'bca' *and* ends with 'b' | $\sum = \{a,b,c\}$	
	Sample Valid: ccabcb, cbcabb *Sample Invalid: cabbb, abcac*	
	c) L = does not contain 'xyz' *and* ends with 'yy' | $\sum = \{x,y,z\}$ (এরপর)	
	Sample Valid: xyy, yy *Sample Invalid: xyzyy, xyxy*	
2.	Design NFAs that accepts the following languages:	3x3
	a) L= starts *and ends* with the same symbol with total length at least 2 | $\sum = \{0,1\}$	
	Sample Valid: 00,11,010,1010101 *Sample Invalid: 100, 0*	
	b) L= contains 'xx' or 'yx' or 'zz' *and* ends with 'yz' or 'y' | $\sum = \{x,y,z\}$	
	Sample Valid: zyxy, zxxzzy *Sample Invalid: xyzyz, yxxz*	
	c) L =starts with '0x0 *and* contains '0' or 'x' *and* ends with '0' | $\sum = \{0,x,y\}$	
	Sample Valid: 0x0,0x0yyy0 *Sample Invalid: 0xx0, 0xy0x*	
3.	Consider the following NFA, and show with the help of NFA-tree whether the string "0011001" is accepted or not.	3

4. Convert the following NFA over alphabet $\Sigma = \{a, b\}$ to an equivalent DFA. 6
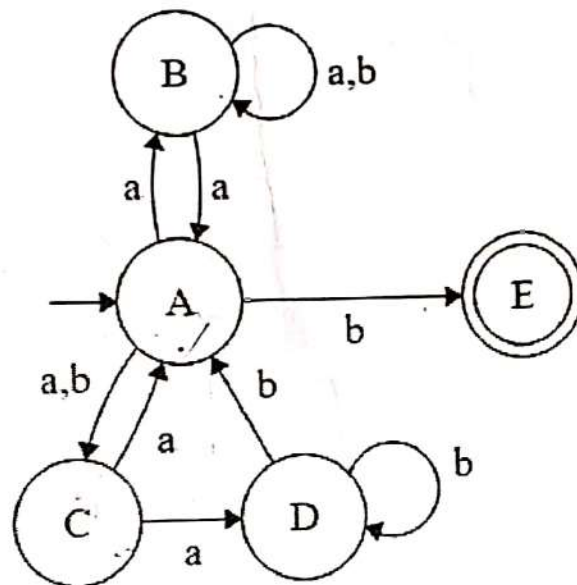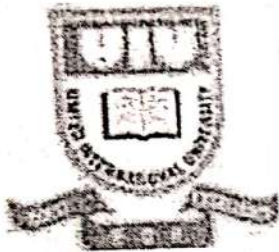

$\{C, E\}$

5. Develop Regular expression over $\Sigma = \{x, y, z\}$ for following languages: 3x1

a) Contains at least three x

b) Number of y is multiple of 4

c) Even length if the string starts with x and Odd length if the string starts with y or z

Convert the following Context-free Grammar into Chomsky Normal Form.   10

S -> ABC | DE
A -> B | CD
B -> aB | ε
C -> EF | b
D -> bD-| ε
E -> aE | F | ε
F -> cF | c

[5+5]

Consider the following language.

$$L = \{a^i\, b^j\, c^k\, d^m \mid k = i + j \text{ and } i, j, k > 0\}$$

(a) Design a pushdown automaton (PDA) for the given language.

(b) Write all the components to represent the above PDA.