United International University (UIU)
Dept. of Computer Science & Engineering (CSE)
Mid Exam. : : Trimester: Summer 2021
Course Code: CSE 2213, Course Title: DISCRETE MATHEMATICS
Total Marks: **20**   Duration: 1 hour
Answer all the questions. Figures are in the right-hand margin indicate full marks.
"Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules."

Question 1.		
a)	Given that A and B are two sets such that: $A \cap \overline{B} = \{10, 22, 31, 76\}$ $B = \{50, 64, 97, 84\}$ (i) Find out $A \cup B$. Order the elements of your set in ascending order. (ii) Given that $A \cap B = \{50, 64, 97\}$, find out $|A|$ (iii) Given that Set C is a single-element set containing the letter 'a', Find out P((A ∩ B) X C)	[1+0.5+1=2.5]
b)	(i) Consider the following function: $f: Z \rightarrow R, f(x) = x^3$ What type of function is this? Explain if this function can have an inverse. (ii) Now consider a different function, g: $g: A \rightarrow B, g(x) = x+1$ $where, A = \{a \in Z^+ \mid a \text{ is even and } a \leq 10\}$ $B = \{b \in Z^+ \mid b \text{ is odd and } b \leq 12\}$ a. State the elements of the domain set, the codomain set and the image set of the function g. b. Find the composition function, $f \circ g$	[1+1+0.5=2.5]
Question 2:		
a)	Write down whether each of the following statements is true or false. Explain the reason of your answer. Domain consists of real numbers. i. $\forall x \forall y (xy < 0 \rightarrow \exists z(z^{xy} > 0))$ ii. $\exists x \forall y (x^y y^x = 1)$ iii. $\forall x \forall y \exists z ((yz)^x = 1)$	[3 x 1 = 3]
b)	Look at the following predicates: $P(x)$: x owns a car. $Q(x)$: x is rich. $R(x, y)$: x drives y's car. Represent the following sentences using the above predicates, appropriate quantifiers and logical connectives. Domain consists of all people. i. There is a rich man who owns a car. ii. A poor man does not own a car. iii. Not all rich man drive their own cars. iv. A man who owns a car is not poor.	[4 x 0.5 = 2]
Question 3:		
a)	Prove that $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a tautology using a sequence of logical equivalences law	[2]
b)	Translate the following sentences into a logical expression. i. I come to class only if there is going to be a CT.	[1 x 3 = 3]

	ii.	For you to get an A in this course, it is necessary and sufficient that you do well in this mid-term exam.	
	iii.	Your guarantee is good whenever you bought your laptop less than 90 days ago or you didn't damage it physically.	
Question 4:			
a)		Prove the following by using the principle of mathematical induction, n is a positive integer. $1^3 + 2^3 + \ldots\ldots + n^3 = (n(n + 1)/2)^2$	[3]
b)		Using direct proof technique, prove that if x even and y odd, then xy is even"..	[2]