



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