United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam. : : Trimester: Spring 2020

Course Code: CSE 2213, Course Title: Discrete Mathematics

Total Marks: **30** Duration: 1 hour 45 min

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

Question 1.		
a)	Find f o g and g o f, where f(x) = x^3 and g(x) = $(x^2 + 1)/(x^2 + 2)$ are functions from R to R.	[1 + 1 = 2]
b)	Determine if the following functions are invertible. i) $f: R - \{1/3\} \rightarrow \boldsymbol{R}, \boldsymbol{f(x) = (2x + 7)/(3x - 1)}$ ii) $f: R \rightarrow R, f(x) = x^3 + 1$	[2 x 2 = 4]
Question 2.		
a)	Draw the Venn Diagram of the following sets. i) $(B' \cup A') \cap C$ ii) $((B - C) \cap (A - B)) \cup C$	[1.5×2=3]
b)	Suppose you have a set S = {a, {b, c}, ∅} i Find the power set P(S). ii Find the cardinality of the set P(P(S)). iii Determine S × S.	[3×1=3]
Question 3:		
a)	Prove $\neg p \rightarrow (q \rightarrow r) \equiv q \rightarrow (p \vee r)$ using logical equivalence laws.	[2]
b)	Construct a truth table for the following compound proposition: $(x \vee (y \leftrightarrow z)) \oplus (\neg x \rightarrow z)$	[2.5]
c)	Write down the converse, contrapositive, and inverse of the following proposition: "He will pass the exam if he studies hard."	[1.5]
Question 4:		
a)	Let $P(x)$ be the statement "x is a football player", $Q(x)$ be the statement "x is physically strong", and $R(x)$ be the statement "x is athletic". Express the following sentences in terms of $P(x), Q(x), R(x)$, quantifiers and logical connectives: (i) There is a football player who is athletic but not physically strong. (ii) Every football player is physically strong or athletic but not both.	[1.5 x 2 = 3]
b)	With brief explanation, determine the truth values of the following propositions. Here, the domain of each variable consists of all real numbers. (i) $\forall x \exists y (y^2 = x)$ (ii) $\exists y \forall x (x^2 + y^2 = x^2)$	[1.5 x 2 = 3]
Question 5:		
a)	Prove the following by using the principle of mathematical induction $\frac{1}{(1 \cdot 2)} + \frac{1}{(2.3)} + \frac{1}{(3.4)} + \ldots\ldots + \frac{1}{\{n(n+1)\}} = \frac{n}{(n+1)}$ where $n \in Z^+$	[3]
b)	Show that, if xy is even, then x is even or y is even. Here, x and y are integers.	[1.5]
c)	Using Proof by Contraposition, prove that, if n is an integer and 7n + 4 is even, then n is also even.	[1.5]