ZIMBABWE EZEKIEL GUTI UNIVERSITY

FACULTY OF HEALTH, SCIENCE AND TECHNOLOGY

DEPARTMENT OF DIGITAL TECHNOLOGY

EXAMINATION PAPER

COURSE CODE	:	CDT 108
COURSE TITLE	:	MATHEMATICAL CONCEPTS FOR COMPUTING
SPECIAL REQUIREMENTS	:	None
DURATION	:	3 Hours
LEVEL	:	1.2
DATE	:	November 2019 15 NOV 2019

INSTRUCTIONS TO CANDIDATES:

1. Answer all questions.

Question 1 (37 marks)

a) State the negation of the following statements in simple English

i) Rumbidzai is rich and happy. (3 marks)

ii) Tonderai will cycle or run tomorrow. (3 marks)

b) Show that $(p \vee q) \wedge (\sim p \vee r) \rightarrow (q \vee r)$ is a tautology. (8 marks)

c) Show that $(p \wedge q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ are not logically equivalent using truth tables. (8 marks)

d) Let $C(x)$ be the statement "x *has a cat*" , $D(x)$ be the statement "x *has a dog*" and $F(x)$ be the statement "x *has a parrot*".
Express each of the following statements in terms of $C(x)$, $D(x)$, and $F(x)$ using quantifiers and logical connectives. Let the domain D consist of all students in your class.

i) A student in your class has a cat, a dog and a parrot.
ii) All students in your class have a cat, a dog and a parrot.
iii) Some student in your class has a cat and a parrot, but not a dog. (3 marks each)

e) Construct a truth table for $\boldsymbol{p \rightarrow \sim q \wedge (q \vee p)}$ (6 marks)

Question 12 (18 marks)

a) Determine the truth value of each of these statements.

i) $\forall n: \mathbb{Z} | n^2 \geq 0$
ii) $\forall n: \mathbb{Z} | n^2 \geq n$
iii) $\exists n: \mathbb{Z} | n^2 = 2$
iv) $\exists n: \mathbb{Z} | n^2 < 0$ (2marks each)

b) Show that the following argument is valid: *If it rains today, the university will close. The university is not closed today. Therefore, it did not rain today.*
(2 marks)

c) Determine whether the argument is valid or invalid. Show all reasoning.
Everybody enrolled in the university has lived in a dormitory. Rudo has never lived in a dormitory. Therefore, Rudo is not enrolled in the university.
(4 marks)

d) Show that if *n* is an integer and $n^3 + 5$ is odd, then *n* is even using (4 marks)

Question 3 (20 marks)

a) Let A be the set of students who live within one kilometre of the university and let B be the set of students who walk to the university. Describe the students in each of these sets.

i) $A \cap B$

ii) $A \cup B$

iii) $A - B$

iv) $B - A$ (2 marks each)

b) Prove that $5^{2n-1} + 1$ is divisible by 6. (6 marks)

c) Suppose the set **A** represents **all tall people**, the set **B** represents **all people who play basketball** and the set **C** represents **all people that play soccer**. For each of the following sets, illustrate them on a Venn diagrams and describe the students in that set.

i) $A \cap (B - C)$ (3 marks)

ii) $(A \cap B) \cup (A \cap C)$ (3 marks)

Question 4 (25 marks)

a) Verify by truth table that **P IMPLIES Q** OR **Q IMPLIES P** is valid. (6marks)

b) A student must choose one of the courses, algorithm, hardware, or programming, as an elective. However, the student is equally likely to choose algorithm or programming and twice as likely to choose hardware. What are the respective probabilities that the student choose algorithm, hardware and programming courses? (6 marks)

c) Create a binary search tree with the follows elements

7 3 2 8 16 5 1 20 22 19 (7 marks)

d) Using the graph in c) traverse using preorder and post order (6 marks)

**********End of Exam**********