ZIMBABWE EZEKIEL GUTI UNIVERSITY

FACULTY OF HEALTH, SCIENCE AND TECHNOLOGY

DEPARTMENT OF DIGITAL TECHNOLOGY

EXAMINATION PAPER

COURSE CODE	:	CDT108
COURSE TITLE	:	MATHEMATICAL CONCEPTS FOR COMPUTING
SPECIAL REQUIREMENTS	:	**None**
DURATION	:	3 Hours
LEVEL	:	1.2
DATE	:	2020

INSTRUCTIONS TO CANDIDATES:

1. Answer all questions.
2. Calculators and slide rules are allowed.
3. Show all the working.

Question 1

a) Represent the following sets in Venn diagrams
   i. B-A [1]
   ii. A∩B [1]
   iii. AU(B∩C) [2]
   iv. A\(B∩C) [2]

b) Let $S = \{t, u, v, w, x, y, z\}$. Determine which of the following partitions of S are and whichones are not giving reasons:
   i. $P1 = [\{t, v, w\}, \{b\}, \{x, w\}]$, [1]
   ii. $P2 = [\{t, v, u, y\}, \{z\}, \{w,x\}]$, [1]
   iii. $P3 = [\{z,x\}, \{t, u\}, \{y, w\}]$, [1]
   iv. $P4 = [\{u, v, w, x, y, v,r\}]$. [1]

Question 2

a) Prove by induction that $1^2+ 2^2+ 3^2+4^2 +\ldots\ldots n^2 = n(n+1)(2n-1)/6$ **[5]**

b) Using indirect proof, prove that given that n is a natural number and n^2 be even then n is even. **[5]**

Question 3

a) Explain the following terms with the aid of diagrams
   i. Injective function **[2]**
   ii. Many to one function **[2]**
   iii. Onto function **[2]**

b) Determine which of the following equations are functions and which are not functions
   i. $y^2=x+1$ **[2]**
   ii. $y=x^2$ **[2]**

Question 4

a) Which of the following expressions are propositions?
   i. The sun is shining [1]
   ii. X-5=7 [1]
   iii. 5-3=21 [1]
   iv. Please come here [1]
   v. Are the roses red? [1]
   vi. What a great book! [1]

b) Show that $P \wedge \neg Q \equiv \neg(P \rightarrow Q)$. [4]

Question 5

a) Given that set A={1, 2, 3} and set B={x, y, z} find
   i. AxB [2]
   ii. BxA [2]
   iii. A^2 [2]

b) Determine giving reasons if A^2 is Reflexive and /or Symmetric [4]

Question 6

a) Compute the following

i. $3!$ **[1]**

ii. $\frac{6!}{5!}$ **[2]**

iii. $\binom{7}{4}$ **[3]**

b) Find the number of permutations that can be formed that can be formed from the letters of the letters

i. DIEGO **[1]**

ii. ISIPHITHIPHITHI **[3]**

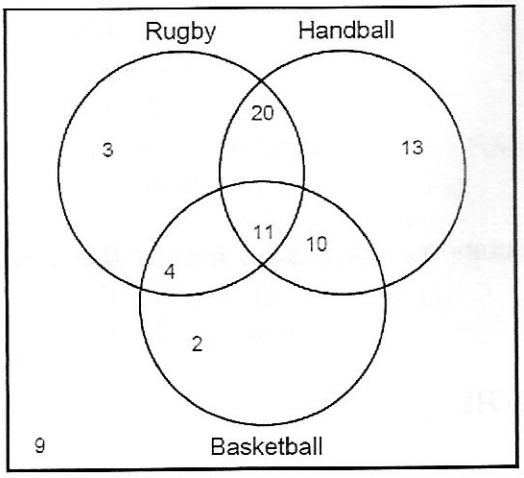
Question 7

a. Draw a directed graph with five vertices and seven edges. Exactly one of the edges should be a loop, and do not have any multiple edges. [4]

b. Draw an undirected graph with five edges and four vertices. The vertices should be called v1, v2, v3 and v4 and there must be a path of length three from v1 to v4. Draw a squiggly line along this path from v1 to v4. [6]

Question 8

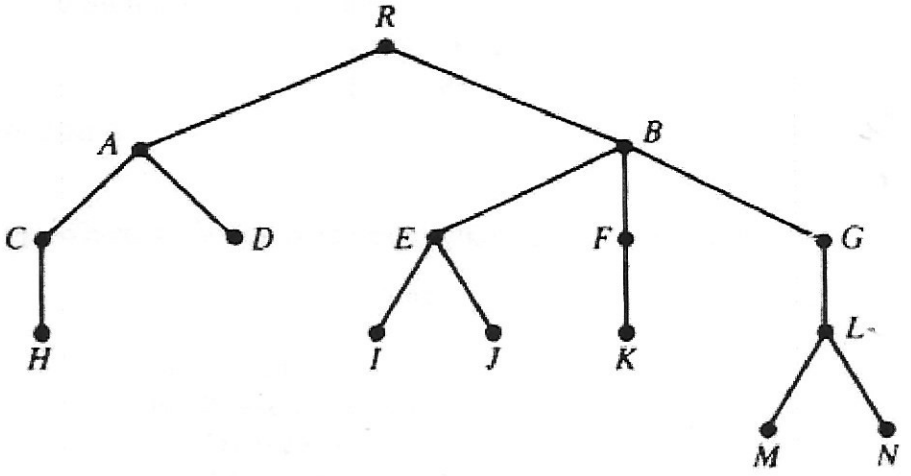
Figure 1



a) The Venn Diagram above represents the numbers of students who play rugby, handball and basketball. Using the Venn diagram answer the questions that follow.

i. Students who play all the three sports **[2]**
ii. All students who play basketball only **[2]**
iii. Students who play either rugby or basketball **[2]**
iv. Students who play rugby but do not play basketball **[2]**
v. Students who do not play basketball [2]

Question 9



Let Tbe the rooted tree in figure above

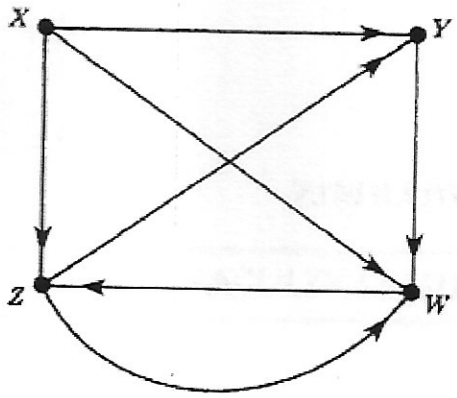
a) Identify the path α from the root R to each of the following vertices, and find the level number n of the vertex:

i. H; **[2]**
ii. F; **[2]**
iii. M. **[2]**

b) Find the siblings of E. **[2]**

c) Find the leaves of T. **[2]**

Question 10



Let G be the directed graph in the diagram above

i. Describe G formally. **[4]**

ii. Find all cycles in G. **[2]**

iii. Find all simple paths from X to Z. **[3]**

iv. Is G strongly connected **[1]**