# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

**FIRST** YEAR **SECOND** SEMESTER EXAMINATION FOR, BACHELOR OF SCIENCE COMPUTER SCIENCE AND, BACHELOR OF SCIENCE COMPUTER TECHNOLOGY

AMM 119 – DISCRETE MATHEMATICS

DURATION: 2 HOURS

DATE:26-04-2019

TIME: 9:00-11:00AM

**Instructions to candidates:**

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

**SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION**

**QUESTION ONE (30 MARKS)**

a) i)List the members of the set $A = \{x | x \text{ is an integer such that } x^2 = 2\}$ 1mark

ii) Use set builder notation to give a description of the set B = {0, 3, 6, 9, 12} 2marks

b) Find the set A and B if A-B = (1, 5, 7, 8), B -A = (2, 10) and $A \cap B = \{3,6,9\}$ 2marks

c) If A = {1, 2, 3, 4} find P(A), the power set of A 4marks

d) Let p(x) be the statement "x+1>2x". If the domain consists of the integers, what are the truth values?

i) p(0) 1mark

ii) $\forall x p(x)$ 1mark

iii) $\forall x \neg p(x)$ 1mark

iv) $\exists\ x \neg p(x)$ 1mark

e) State the rule of inference used in each of these arguments:

i) If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed 1mark

ii) Stacy is a mathematics major and computer science major. Therefore, Stacy is a Mathematics major. 1mark

iii) If I work all night on then homework, then I can answer all the exercise. If I answer all the exercises, I will understand the material. Therefore, if I work all night on this homework, then I will understand the material 1mark

(f) Let $f: Z \to Z \; with \; f(x = 2x + 1)$. Determine whether f is one–on-one and onto 4marks

g) Determine whether these conditional/biconditional statements are true or false

i) 1+1 = 2, then 2+2 = 5 1 mark

ii) If 1+1 = 3, then dogs can fly 1mark

iii) 0>1 if and only if 1 =2 1mark

h) Show using mathematical induction that $2(4^n) + 1$ is divisible by 3 for $n \in$N 4marks

i) Determine the number of ways the word HALLUCINATIONS can be written 3marks

**SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION**

**QUESTION TWO (20 MARKS)**

a) Prove using mathematical induction that $1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdots + n(n+1) = \frac{n(n+1)(n+2)}{3}$

6marks

b) If f,g:$R \to R$defined by $f(x) = 2x^2 + 1$ and $g(x) = 7x^2 + 6$, compute

i) $f^{\circ}g(1)$ 3marks

ii) $g^{\circ}f(1)$ 3marks

c) Given that $f(x) = \frac{2x+5}{3x+7}$then, find $f^{-1}$ 3marks

d) Name the following laws of arithmetic

i) x(y+z) = xy + yz 1mark

ii) (x+y) + z = x + (y+z) 1mark

e) Let f:$R \to R$ be defined by f(x) = 2x +3. Determine whether f is 1-1 or not 3marks

**QUESTION THREE (20 MARKS)**

a) Test the validity of the argument below:

If 3-5≥7 then either it is rainy or Arsenal will win the league. It is not rainy or Arsenal will not win the league. 3-5<7 if and only if it is not rainy. Therefore if Arsenal will win the league, 3-5≥7. 6marks

b) Write the inverse, converse and contrapositive of the following statement " if 6+1≥8, then goats can dance" 3marks

c) A breakfast survey conducted at MRU revealed the following patterns 500 students take uji, 300 students take ugali, 200 students take tea, 150 students take uji and ugali, 130 students take uji and tea, 105 students take ugali and tea and 85 students take ugali, tea and uji.

i) Illustrate the findings using a venn diagram 3marks

ii) How many students take utmost two items 2marks

iii) How many students take at least two items 2marks

iv) How many students take none of the items above 2marks

d) By use of a truth table compute $\big((\sim p \rightarrow \sim r) \leftrightarrow (r \rightarrow p)\big)$ 2marks

**QUESTION FOUR (20 MARKS)**

a) Show that the proposition $p \rightarrow q$ and$\sim p$Vq are logically equivalent
6marks

b) Determine the domain of each of the following functions

i) $f(x) = \sqrt{16 - x^2}$ 2marks

ii)$g(x) = \frac{1}{(x-2)(x-3)}$ Type equation here.
2marks

c) If A = {a, b} and B = {1, 2, 3}, determine A x B

d) A team of 4 is chosen at random from 5 girls and 6 boys. In how many ways can the team be chosen if;

i) There are no restrictions 3marks

ii) There must be more boys than girls 4marks