(*Knowledge for Development*)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATION
YEAR ONE SEMESTER ONE EXAMINATION

FOR THE DEGREE OF
BACHELOR OF SCIENCE
(INFORMATION TECHNOLOGY)

COURSE CODE : BIT 114

COURSE TITLE : MATHEMATICS FOR IT

DATE: 29/01/2021 **TIME: 8.00 A.M. – 10.00 A.M**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION one (COMPULSORY) [30 MARKS]

i. Define the following terms:

  a. Urelement (1Marks)

  b. Universal set (1 Marks)

  c. Total function (2 Marks)

ii. Consider a set U = {x, y, z}. Determine the powerset of U. (3 Marks)

iii. Show that the set of all positive even numbers E = { 2, 4, 6, 8, . . . } is countably infinite. (4 Marks)

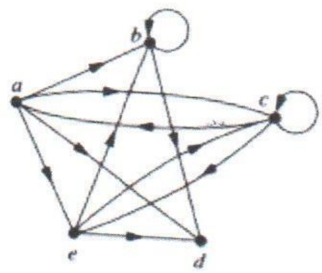
iv. With the aid of venn diagrams, describe the following terms with respect to sets:

  a. Intersection (2 Marks)

  b. Difference of a set (2 Marks)

  c. Proper subset (2 Marks)

v. Consider the graph below.



Use adjacency lists to describe the simple graph. (5 marks)

vi. Let *f* and *g* be functions from the set of integers defined by $f(x) = 3x^2 - x + 10$ and $g(x) = 1 - 20x$

  a. Evaluate the composition of *f* and *g* $(f \circ g)(x)$ (4 Marks)

  b. Evaluate the composition of *g* and *f* $(g \circ f)(x)$ (4 Marks)

QUESTION TWO [20 MARKS]

i. Find the cardinality of the following set:

D = {0, 1, 2, {0, 1}, (1,21, {0, 1, 2}, A) (2 Mark)

ii. Let A, B, C be any 3 sets. If A ⊆ B and B ⊆ C. With the aid of a venn diagram, prove that A ⊆ C (5 Marks)

iii. Determine the value of $\frac{d}{dx}(\frac{1}{\cos x})$ (6 marks)

iv. Prove that A = (A - B) ∪ (A ∩ B) for all sets A, B applying set identity theorems

(7 Marks)

QUESTION THREE [20 MARKS]

i. Let X = {{ b, c } , {{ b } , { c }} , b } and Y = { a, b, c } . Determine

a. set di□erence of X and Y (2 Marks)

b. set di□erence of Y and X (2 Marks)

c. symmetric di□erence of X and Y (2 Marks)

ii. X and Y are two non-empty sets where their relation R = { (1, a), (1, b), (2, c) }. Determine R^{-1}. (2 Marks)

iii. Consider the function $f: A \rightarrow B$, where A = {a,b,c,d,e} is the domain f, B = {1,2,3,4} is its codomain.

a. Draw the function arrow diagram for f = {(a,1), (b,3), (c,4),(d,2),(e,3)}.

(5 Marks)

b. Explain the relation of the function (2 Marks)

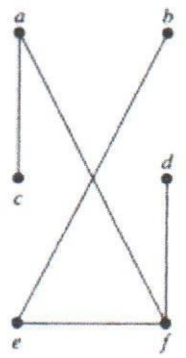
iv. Using sets A and B containing any arbitrary number of elements, describe a total bijective function (5 Marks)

QUESTION FOUR [20 MARKS]

i. If A and B are sets where A = {{1, 2}, {3}} and B = {(a, b), (c, d)}, show that

$A \times B \neq B \times A$ (4 Marks)

ii. Consider the following graphs.



A

B

State and explain which graph forms a tree. (4 Marks)

iii. Differentiate the function h = $\frac{4\sqrt{x}}{x^2-2}$ applying quotient rule (6 marks)

iv. Using membership table, prove that A n (B U C) = (A n B) U (A n C) for all sets A, B, and C. (6 Marks)

QUESTION FIVE [20 MARKS]

i. Let A = {a, b, c, d} and let R = {(a, b), (b, c), (c, d), (d, b)} be a relation on A.

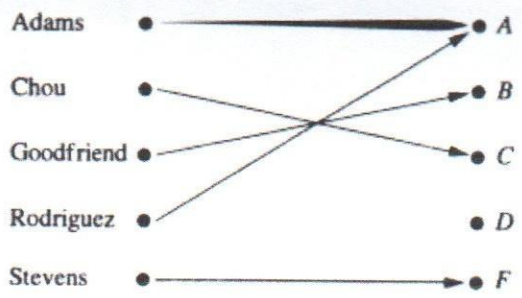
a. Draw the directed graph representing R. (2 Marks)

b. Determine the transitive closure R* of R. (3 Marks)

ii. A set S is defined recursively by Basis step: $0 \in S$ and Recursive step:

if $a \in S$ then $a + 3 \in S$ and $a + 5 \in S$. Determine the set $S \cap \{a \in Z \mid 0 < a < 12\}$. (2 Marks)

iii. A function G which assigns grades to students is illustrated below.



Determine the

a. Domain (1 Marks)

b. Codomain (1 Marks)

c. Range (1 Marks)

iv. Suppose that the amount of water in a holding tank at t minutes is given by $V(t) = 2t^2 - 16t + 35$. Determine if the volume of water in the tank increasing or decreasing at $t = 5$ minutes. (3 marks)

v. Determine the integral of the function $\int \frac{4x^{10} - 2x^4 + 15x^2}{x^3} dx$ (7 marks)