(KNOWLEDGE FOR DEVELOPMENT)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

FIRST YEAR FIRST SEMESTER

FOR THE DEGREE IN INFORMATION TECHNOLOGY

COURSE CODE: BIT 111

COURSE TITLE: DISCRETE STRUCTURES FOR IT (A)

DATE: 10/01 2018 **TIME:** 2.00PM-5.00 PM

INSTRUCTIONS

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [30 MARKS]

a. Differentiate between the following terms and concepts as used in the study of discrete structures in IT.? **[6 marks]**

i. Finite and infinite sets

ii. A function and a relation

iii. Permutation and combination

b. Given sets: $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5\}$. Define the Cross product of A and B **[3 marks]**

c. Verify that the proposition $p \vee \neg (p \wedge q)$ is a tautology **[4 marks]**

d. Evaluate: **[4 marks]**

i. ${}_5P_3$ ii. ${}_6C_4$

e. State the ***Pigeonhole Principle***. Using this principle, determine the least number of students in a group who have been born in the same month. **[4 marks]**

f. Use the Euclidean algorithm to compute the greatest common divisor GCD (75; 12). Otherwise, compute the least common multiple LCM (75; 12). **[4 marks]**

g. **Let** $f(x) = 12x^2 - 17$. Find the inverse $f'(x)$ of $f(x)$. **[3 marks]**

h. **Using** suitable inputs illustrate an OR-gate and AND-gate **[3 marks]**

QUESTION TWO [20 MARKS]

a. List the elements of the following sets, here N={1,2,3,---} **[3 marks]**

i. A={x: x∈ N, 3<x<12}

ii. B={ x: x∈ N, x is even , x<13}

iii. C= {x: x∈ N, 4+x=3}

b. A universal set U is defined as U={0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11} and the subjects A,B and C are such that A={0,2,4,6}, B={1, 3, 6, 7, 8, 9} and C={6, 8, 9,11}. Find

i. $|A \cup B|$ **[2 marks]**

ii. $A \cap C$ **[1 mark]**

iii. $A \cap (C \cup B)$ **[2 marks]**

iv. $(A \cup B \cup C)'$ **[2 marks]**

Consider the following data for 120 Information Technology Students concerning the languages they study: 65 study Java, 45 study Python, 42 study Ruby, 20 study Java and Python, 25 study Java and Ruby, 15 study Python and Ruby and 8 study all the three languages.

i. Represent these information on a Venn diagram [4 marks]

ii. Find the number of students who study only one Language [1 marks]

iii. Find the number of students who study exactly two languages [1 marks]

iv. Find the number of students who study at least a languages Language [2 marks]

v. Find the number of students who do NOT study any Language [2 marks]

QUESTION THREE [20 MARKS]

a. i. Explain whether "*1+2 = 6*", " *2+1=3*", "*x+2=4*" are prepositions. [3 marks]

ii. Let p be "It is cold" and let q be "It is raining". Give a simple verbal sentence which describes each of the following statements: $\neg p$; $p \wedge q$; $p \vee q$; $q \vee \neg p$. [4 marks]

b. Show that the propositions $\neg(p \wedge q)$ and $\neg p \vee \neg q$ are logically equivalent. [4 marks]

c. i. Using a suitable Example Logic Gates [3 marks]

ii. Construct a truth table and a logic diagram that implements the following expression.

$$W=\overline{X+Y}+X\bar{Z}$$

[6 marks]

QUESTION FOUR [20 MARKS]

a. Given the functions $f(x) = 2x^2-3$ and $h(x) =3x+2$. Find

i. The domain and the range of h(x) [2 marks]

ii. f(g(x)) [4 marks]

iii. f(2) [2 marks]

iv. whether h(x) is one-to-one mapping [2 marks]

b. Let A= {1, 2, 3, 4, 6} and R be a relation of A defined by "x divide y" written x|y , there exist an integer z such that xz=y.

i. Write R as a set of ordered pairs. [4 marks]

ii. Draw its directed Graph. [3 marks]

iii. Find the inverse relation R^{-1} of R. can R^{-1} be described in words. [3 marks]

QUESTION FIVE [20 MARKS]

a. Prove by contradiction that if $5n + 1$ is an even integer, then n is even **[5 marks]**

b. **i.** Use the Euclidean Algorithm to show that 34 and 105 are relatively prime. **[3 marks]**

ii. Find the inverse of 34 modulo 105. **[3 marks]**

c. A class contains 10 students with 6 men and 4 women. Find the number n of ways to:

i. Select a 4-member committee from the students. **[3 marks]**

ii. Select a 4-member committee with 2 men and 2 women. **[3 marks]**

iii. Elect a president, vice president, and treasurer. **[3 marks]**