(KNOWLEDGE FOR DEVELOPMENT)

KIBABII UNIVERSITY
(KIBU)

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS
FIRST YEAR FIRST SEMESTER

FOR THE DEGREE IN
(INFORMATION TECHNOLOGY/ COMPUTER SCIENCE)

COURSE CODE: BIT 111/CSC 112

COURSE TITLE: DISCRETE STRUCTURES

DATE: 29/01/2021   **TIME:** 11.00 A.M. - 1.00 P.M.

INSTRUCTIONS

ANSWER QUESTIONS ONE and ANY OTHER TWO.

QUESTION ONE (COMPULSORY)   [30 MARKS]

a. Write the truth table of the following two formulas $(p \wedge \neg (q \vee r))$ and $(\neg p \vee (q \vee r))$. Say for each one if it is a tautology, satisfiable or contradiction. Say if one is a logical consequence of the other.   [4 marks]

b. Evaluate the following

   i. $C_{(11, 5)}$ [2 marks]

   ii. $P_{(7, 3)}$ [2 marks]

c. In a survey of 100 students , if was found that 40 studied mathematics , 64 studied physics 35 studied chemistry , 1studied all 3 subjects , 25 studied maths and physics , 3 studied math's and chemistry and 20 studied physics and chemistry . Find the number of students who studied chemistry only.   [5 marks]

d. Let P(x,y) denote the statement x = y+ 3. What are the truth values of the Proposition P(1,2) , P(3,0).   [2 marks]

e. Let R be the relation on the set A = {1, 2, 3, 4, 5, 6, 7} defined by the rule $(a, b) \in R$ if the integer $(a - b)$ is divisible by 4. List the elements of R and its inverse.   [3 marks]

f. Bob want to buy 12 muffins and finds 7 different types available. In how many ways can he make his selection, if each type has enough many pieces? (You do not need to simplify.   [4 marks]

g. Let $f: R \rightarrow R$ be defined by $f(x) = 2x^2 - 1$.

   i.   Find domain, target (or codomain), and range of f.   [3 marks]

   ii.   Is f one-to-one? Justify your answer.   [3 marks]

   iii. Is f onto? Justify your answer.   [2 marks]

QUESTION TWO   [20 MARKS]

a. i. Using Euclidean algorithm find the GCD and LCM of 31415 and 1412.   [3 marks]

   ii. Find the value of x and y in $\mathbf{x}(31415)+ \mathbf{y}(1412)=\gcd(31415, 1412)$. [4 marks]

b. Prove by the method of induction that for all n∈N then,

$$\frac{1}{3*5}+\frac{1}{5*7}+\frac{1}{7*9}+\ldots+\frac{1}{(2n+1)(2n+3)}=\frac{n}{3(2n+3)}$$

[6 marks]

QUESTION THREE   [20 MARKS]

a. Let $A = \{3,5,7,9\}$, $B = \{2,3,5,6,7\}$, and $C = \{2,4,6,8\}$ be all subjects of the universe $U =\{2,3,4,5,6,7,8,9\}$. Find

    i.   the union of A and B;   [2 marks]

    ii.   the intersection of B and C;   [2 marks]

    iii.   the complement C of the set C;   [2 marks]

b. Of 100 students in a university department, 45 are enrolled in English, 30 in History, 20 in Geography, 10 in at least two of three courses and just 1 student is enrolled in all three courses.

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

ii. How many students take none of these courses?   [2 marks]

c. The students who stay in hostel were asked whether they had a textbook and a digest in their rooms. The results showed that 650 students has text, 150 did not have a textbook, 175 had digest and 50 had neither a textbook nor a digest. Find:

    i. The number of students in the hostel   [3 marks]

    ii. How many have both a textbook and digest   [3 marks]

    iii. How many have only a digest   [2 marks]

QUESTION FOUR   [20 MARKS]

a. Given sets A, B and C such that all are non-empty sets. State the inclusive-exclusive principle.   [2 marks]

b. Write the predicate notation for the following statements:

i.   Some students in Discrete Mathematics class smoke   [2 marks]

ii.   Jane loves anybody who is a musician and sings gospel   [2 marks]

c. Give the f(x) $=\frac{x+1}{x^2}$, g(x) $=3x^2+4$ and h(x) $=\frac{x^2-1}{x+1}$ find:

i.   Domain and range of f(x) and h(x)   [2 marks]

ii.   The inverse $g^{-1}(x)$ of g(x)   [3 marks]

iii. Is g(x) bijective? Explain.   [2 marks]

iv.   f(g(h(x)))   [4 marks]

v.   g(h(2))   [3 marks]

QUESTION FIVE   [20 MARKS]

a. Let R be the relation on the set A = {1, 2, 3, 4, 5, 6, 7} defined by the rule $(a, b) \in R$ if the integer $(a - b)$ is divisible by 4. List the elements of R and its inverse.   [4 marks]

b. Let A = {2, 3, 4, 5 } and let R = {(2, 3), (3, 3), (4, 5), (5, 1)}.Is R symmetric, asymmetric or antisymmetric?   [2 marks]

c. Let A = {1, 2, 3, 4, 6} and R be the relation on A defined by "x divides y", written an $x \mid y$.

i.   Write R as a set of ordered pairs.   [2 marks]

ii.   Draw a directed graph of R.   [2 marks]

iii. Write down the matrix of relation R.   [2 marks]

iv.   Find the inverse relation R–1 of R and describe it in words.   [2 marks]

d. Say the only clothes you have are 2 t-shirts, 4 pairs of jeans and 6 pairs of shoes. In how many combinations you can choose a t-shirt, a pair of jeans and a pair of shoes?   [3 marks]

e. How many students must be in a class to guarantee that at least 4 students receive same score on the final exam, if the exam is graded on a scale from 0 to 100 points   [3 marks]