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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2016/2017 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 15th August, 2016.
Time: 11.00am – 1.00pm

KMA 105 - DISCRETE MATHEMATICS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Define the following terms;

i) Corollary

ii) Cardinality of sets

iii) Contigency

iv) Proposition

(2 Marks)

b) Let A and B be two sets. Find $A - B$ (use Venn diagram)

(2 Marks)

c) Get the number of integers between 1 and 100 inclusive that are divisible by either 3, 5 or 7

(8 Marks)

d) Let p, q and r be three propositions. Formulatethe truth table for $p \wedge q \wedge r$ and the corresponding Venn diagram.

(4 Marks)

e) If $f(x) = x^2 + 1$and $g(x) = 2x - 5$. Find;

i) fog and

(2 Marks)

ii) gof

(2 Marks)

f) For any three non-empty sets A, B, C, show that;
$A \times (B \cap C) = (A \times B) \cap (A \times C)$

(5 Marks)

g) Prove that if $3n + 2$ is odd, then n is odd

(3 Marks)

h) Verify that $p \vee \sim (p \wedge q)$is a tautology using truth table

(2 Marks)

QUESTION TWO (20 MARKS)

a) Out of a group of 85 people, 30 invested in the stock market, 45 had certificates of deposits(CD's) and 44 had savings bonds. Furthermore, 23 had both CD's and bonds, 13 had both CD's and stocks. Finally, 10 of the people have no investment. Use Venn diagram to determine how many of the people had;

i) All the three types of investments

(6 Marks)

ii) At least two investments

(2 Marks)

iii) At most two investments

(2 Marks)

iv) CD'S only

(1 Mark)

b) Establish whether the following argument is valid or not valid;

$$\begin{array}{lll} p & \rightarrow & q \\ q & \rightarrow & r \\ \hline p & \rightarrow & r \end{array}$$

(6 Marks)

c) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = 2x + 4$. Determine if f is an injection, bijection or surjection

(3 Marks)

QUESTION THREE (20 MARKS)

a) Using Boolean algebra show that $(A - C) - (B - C) = (A - B) - C$

(10 Marks)

b) Simplify $A \cap (A' \cup B)$

(3 Marks)

c) If $A = \{x: 1 \leq x \leq 5\}$and $B = \{y: 3 \leq y \leq 9\}$. Find $A \oplus B$

(2 Marks)

d) Prove that if $A \subset C$ and $D \supset B$, then $(C \cup D) \supset (A \cup B)$

(5 Marks)

QUESTION FOUR (20 MARKS)

a) Compute $p \rightarrow q \wedge [(q \wedge \sim r) \rightarrow (p \vee r)]$

(5 Marks)

b) Find the converse, inverse and contra positive of "if today is Thursday, then I have a class today"

(6 Marks)

c) Let p and q be two propositions. Show that;

$i)$ $p \rightarrow q$ and $\sim p \vee q$ are logically equivalent

(5 Marks)

$ii)$ $(p \wedge q) \rightarrow (p \vee q)$is a tautology.

(4 Marks)

QUESTION FIVE (20 MARKS)

a) Prove using mathematical that the sum of the first n natural numbers is $^1/_6\,(n+1)(2n+1)$

(10 Marks)

b) Prove the following using a convenient method of proof;

i) If x is odd and y is even, then xy is even.

(5 Marks)

ii) $\sqrt{2}$ is irrational

(5 Marks)