ALUPE UNIVERSITY COLLEGE

... *Bastion of Knowledge*....

OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH
UNIVERSITY EXAMINATIONS

2021 /2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: COM 113

COURSE TITLE: MATHEMATICS FOR COMPUTER SCIENCE I

DATE: 19TH JANNUARY, 2022   TIME: 1400 – 1700 HRS

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 3 PRINTED PAGES   PLEASE TURN OVER

COM 113

REGULAR-MAIN EXAM

COM 113: MATHEMATICS FOR COMPUTER SCIENCE I

STREAM: COM   DURATION: 3 Hours

INSTRUCTION TO CANDIDATES
Answer ALL questions from section A and any THREE from section B.
SECTION A (24 MARKS)

Question One (12 Marks)

a) Define the following terms   [5 Marks]
   i)   A set
   ii) Empty set
   iii) Universal set
   iv) Disjoint set
   v)   Cardinality of a set
b) Given two functions $f(x) = 5x - 3$ and $g(x) = (2x - 3)/(3x - 5)$.
   i)   Show that $(f_o g)(x) \neq (g_o f)(x)$ [3 Marks]
   ii) Find$(f_o g)^{-1}(x)$ and hence $(f_o g)^{-1}(2)$ [4 Marks]

Question Two (12 Marks)

a) List the ordered pairs in the relation R from A = {0, 1, 2, 3, 4} to B = {0, 1, 2, 3}, where (a, b)
$\in R$ if and only if

   i)   a = b.   [2 Marks]
   ii) a + b = 4.   [2 Marks]
   iii) a > b.   [2 Marks]
   iv) a | b.   [2 Marks]

b) Show that the relation R on a set A is symmetric if and only if $R = R^{-1}$, where R^{-1} is the
inverse relation.   [4 Marks]

SECTION B (36 MARKS)

Question Three (12 Marks)

a) Let A = {0, 2, 4, 6, 8, 10}, B = {0, 1, 2, 3, 4, 5, 6}, and C = {4, 5, 6, 7, 8, 9, 10}. Find:
   i)   A ∩B ∩C.   [2 Marks]
   ii) A ∪ B ∪ C.   [2 Marks]
   iii) (A ∪ B) ∩C.   [2 Marks]
   iv) (A ∩B) ∪ C.   [2 Marks]

b) Show by induction that for every natural number n ≥ 5, $n^2 < 2^n$ [4 Marks]

Question Four (12 Marks)

a) Define an injunction [2 Marks]

b) Using a figure, determine whether the function f from {a, b, c, d} to {1, 2, 3, 4, 5} with f(a) = 4, f(b) = 5, f(c) = 1, and f(d) = 3 is one-to-one. [4 Marks]

c) Draw the Venn diagrams for each of these combinations of sets A, B, and C.

    i) $A \cap (B - C)$ [2 Marks]

    ii) $(A \cap B) \cup (A \cap C)$ [2 Marks]

    iii) $(A \cap \bar{B}) \cup (A \cap \bar{C})$ [2 Marks]

Question Five (12 Marks)

a) Define a recurrence relation [2 Marks]

b) Let A = {a, b, c}, B = {x, y}, and C = {0, 1}. Find

    i) $(A \times B \times C)$. [2 Marks]

    ii) $(C \times B \times A)$. [2 Marks]

    iii) $(C \times A \times B)$. [2 Marks]

    iv) $(B \times B \times B)$. [2 Marks]

    v) A^2 [2 Marks]

Question Six (12 Marks)

a) Let $t_0, t_1, t_2, \ldots$ be defined by the formula $t_n = 2 + n$ for all integers $n \geq 0$. Show that this sequence satisfies the recurrence relation $t_k = 2t_{k-1} - t_{k-2}$ [4 Marks]

b) Use a membership table to show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$. [8 Marks]

Question Seven (12 Marks)

A professor in a discrete mathematics class passes out a form asking students to check all the mathematics and computer science courses they have recently taken. The finding is that out of a total of 50 students in the class,

          30 took precalculus;

          16 took both precalculus and Java;

          18 took calculus;

          8 took both calculus and Java;

          26 took Java;

          47 took at least one of the three courses.

          9 took both precalculus and calculus;

Using a Venn diagram, solve the following questions.

    i) How many students did not take any of the three courses? [4 marks]

    ii) How many students took all three courses? [4 marks]

    iii) How many students took precalculus and calculus but not Java? How many students [4 marks]

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