MAASAI MARA UNIVERSITY

UNIVERSITY EXAMINATIONS 2023/2024 (REGULAR)
YEAR ONE SEMESTER TWO

SCHOOL OF SCIENCE AND INFORMATION SCIENCES

UNIVERSITY EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

COURSE CODE: COM 1209-1

COURSE TITLE: DISCRETE STRUCTURE

DATE: 17/5/24 **TIME: 1100-1300HRS**

INSTRUCTIONS

- Answer Question ONE and any other TWO

SECTION – A

QUESTION ONE (COMPULSORY 30 MARKS)

a) Draw the graph with the following adjacency matrix. **(2 Marks)**

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array} \begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 2 & 0 \\ 0 & 2 & 0 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

b) Rewrite the following statements using set notation:

(i) the element 1 is not a member of A

(ii) A is a subset of B **(2 Marks)**

c) Simplify $\frac{(n+1)!}{(n-1)!}$ **(4 Marks)**

d) Construct logic networks for the following Boolean expressions, using AND gates, OR gates, and inverters. $(\bar{x} + y)z$ **(3 Marks)**

e) A group consists of nine men and six women. Find the number m of committees of six that can be selected from the class. **(2 Marks)**

f) The relation R on a set is represented by

$M_R = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ is R reflexive, symmetric or antisymmetric? **(2 Marks)**

g) Draw the complete bipartite graphs $K_{2,3}$ **(2 Marks)**

h) Draw the relation graph for the following relations

(i) R = {(1,1), (1,3), (2,1), (2,3), (2,4), (3,1), (3,2), (4,1)} on the set X= {1,2,3,4}

(ii) S = {(1,1), (1,2), (1,3), (2,2), (2,3), (3,3)} on the set Y= {1,2,3}

(4 Marks)

i) Determine which of the following sets are finite.

(i) A= {seasons in the year}

(ii) B= {state in the union}

(iii) C= {+ve integers less than 1} **(3 Marks)**

j) Use a K-map to find the minimal form for each of the following complete sum-of-products Boolean expressions and draw the logic circuit diagram.

$E_1 = ABC + AB\overline{C} + A\overline{B}C + \overline{A}BC + \overline{A}\,\overline{B}C$ **(6 Marks)**

SECTION - B:

QUESTION TWO (20 MARKS)

a) Consider the following sets:

(I) X= {x: x is an integer, x>1}
(II) Y= {y: y is an positive integer, divisible by 2}
(III) Z= {z: z is an even number, greater than 2}

Which of them are subset of w = {2, 4, 6…….}? **(3 Marks)**

b) Determine the power set P (A) of A= {1, 3, 5} **(4 Marks)**

c) Find the number of distinct permutations that can be formed from all the letters of each word "EXAMINATION" **(2 Marks)**

d) Construct the truth table for $p \wedge (p \vee q)$ **(4 Marks)**

e) Suppose U= {1,2, 3…..8,9}, A= {1,2,3,4}, B= {2,4,6,8}, and C= {3,4,5,6}. Find

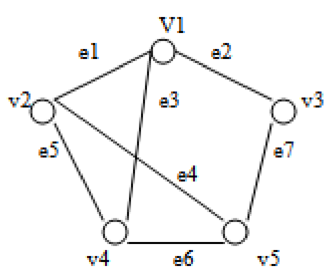
(i) $(A \cup B) \cup C$ and (ii) $A \cup (B \cup C)$ **(4 Marks)**

f) Determine which of the following sets are finite.

(iii) A= {seasons in the year}
(iii) B= {state in the union}
(iii) C= {+ve integers less than 1} **(3 Marks)**

QUESTION THREE (20 MARKS)

a) Find the adjacency matrix A of the graph G in figure.



(4 Marks)

b) One hundred students were asked whether they had taken courses in any of the three areas, ***Computer***, ***Physics***, and ***History***. The results were:

26 had taken ***Computer***
22 had taken ***Physics***
33 had taken ***History***
6 had taken ***Computer*** and ***Physics***
8 had taken ***Computer*** and ***History***
5 had taken ***History*** and ***Physics*** and
2 had taken all the three courses.

I. Draw a Venn diagram that will show the results of the survey. **(3 Marks)**

II. Determine the number of students who had taken exactly ONE of the courses. **(1 Mark)**

III. Number of Students who had taken exactly TWO of the courses. **(1 Mark)**

IV. Number of Student who have taken NONE of the courses. **(1 Mark)**

c) Prove $x + \bar{y} = x + (\bar{\bar{x}} \,.\, \bar{y} + \overline{x.y})$ **(2 Marks)**

d) Prove that $x \oplus y = y \oplus x$ **(3 Marks)**

e) Draw all trees with five vertices **(5 Marks)**

QUESTION FOUR (20 MARKS)

a) Draw the logical networks for

(i) $(a.\bar{b}) + (\bar{a}.b)$

(ii) $(a + b).(c + d)$ **(4 Marks)**

b) Consider the following three relations on the set A= {1, 2, 3}:

R= {(1, 1), (1, 2), (1, 3), (3, 3)}

S = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3)}

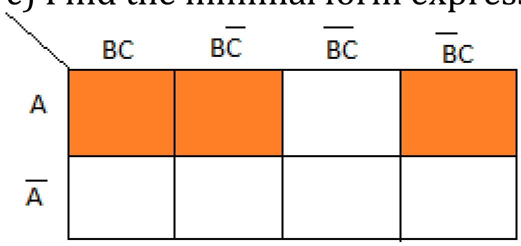
T = AXA

(i) Determine which of the relations are reflective.

(ii) Determine which of the relations are symmetric.

(iii) Determine which of the relations are transitive. **(3 Marks)**

c) Find the minimal form expression of K-Map given below: -



(2 Marks)

d) Prove the associative law: $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$ **(4 Marks)**

e) Draw the K-Map of the following expression. $Z = f(A,B,C) = ABC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + AB\bar{C}$ **(2 Marks)**

f) Suppose the truth table of an expression is T= [A=00001111, B= 00110011, C= 01010101, L= 11101001

(i) Find out the Expression of given truth table.

(ii) Draw the K-Map and find the minimal form of this. **(5 Marks)**

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