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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
KMA 2110 – MATHEMATICS FOR INFORMATION TECHNOLOGY

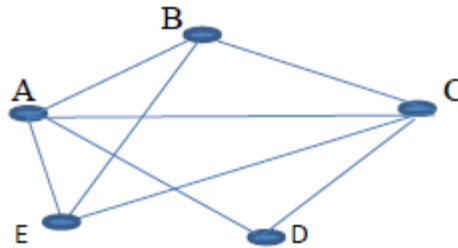
Date: 13TH December 2024
Time: 8:30AM – 10:30AM

INSTRUCTIONS TO CANDIDATES

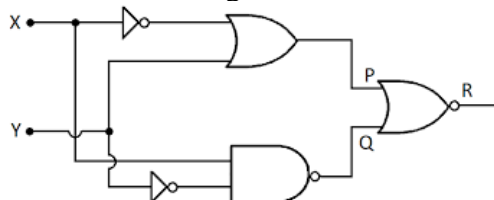
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- a) Given the following sets $A = \{4,5,7,8\}$ and $B = \{4,5,9\}$ and $C = \{1,4,6,9\}$. Verify that
$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$
 (3 Marks)
- b) Consider the graph given below.



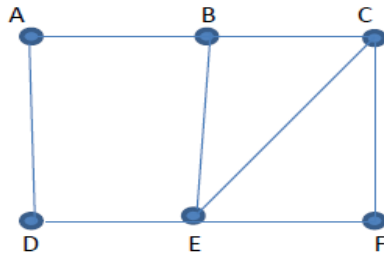
- a.
- Describe G formally. (3 Marks)
 - Find the degree of each edge. (2 Marks)
 - State and verify the Handshaking Lemma for this graph. (2 Marks)
- c) Find the derivative of the following functions:
- $y = (6x^3 - 4x)^3$ (3 Marks)
 - $y = \frac{e^{2x}}{\tan x}$ (3 Marks)
 - $y = (3x + 4) \cos 8x$ (3 Marks)
- d) Find the output of the following network:



- (3 Marks)
- e) Draw the graph G represented by the adjacency matrix is $A = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$. (4 Marks)
- f) A computer company must hire 20 programmers to handle programming jobs and 30 programmers for applications programming. Of these hired, 5 are expected to perform jobs oof both types. How many programmers must be hired? (4 Marks)

QUESTION TWO (20 MARKS)

- a) Among a group of 120 students, 50 played cricket, 50 played hockey and 40 played volley ball. 15 played both cricket and hockey, 20 played both hockey and volley ball, 15 played cricket and volley ball and 10 played all three.
- Draw a Venn diagram to represent this information (4 Marks)
 - Determine the number of students who did not play any of the three games. (2 Marks)
 - Determine the number of students who played exactly one of the three games. (2 Marks)
 - Determine the number of students who played exactly one of the three games. (2 Marks)
- b) Let G be the graph given below



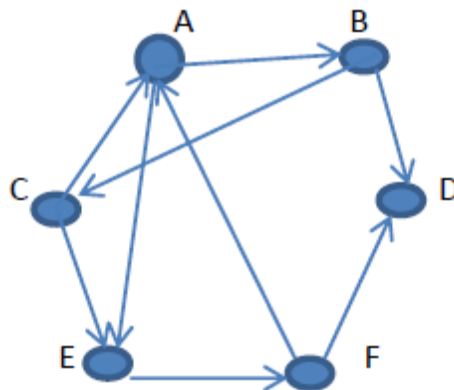
- Subgraph H generated by {B, C, E, F}. (2 Marks)
- All bridges in graph G. (2 Marks)
- All cut points in graph G (2 Marks)
- Diam (G), the diameter of G. (2 Marks)
- Distance from A to C (2 Marks)

QUESTION THREE (20 MARKS)

- a) Draw the graphs having the following matrices as its adjacency matrices.

- i)
$$A = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$
 (5 Marks)
- ii)
$$A = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix}$$
 (5 Marks)

- b) Let G be the graph given below.



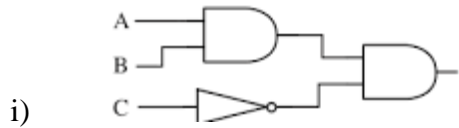
Find:

- Find two simple paths from A to F (2 Marks)
- All cycles in graph G. (3 Marks)

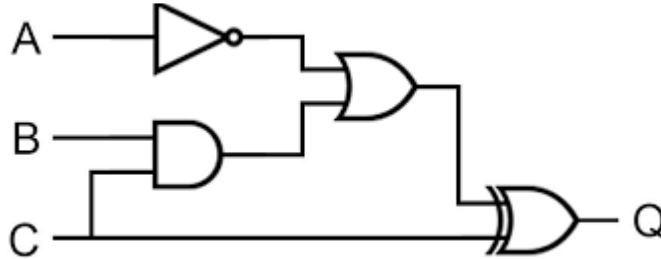
- iii) Subgraph H generated by $\{A, E, F\}$. (2 Marks)
- iv) Are there any sources or sinks of graph G? (3 Marks)

QUESTION FOUR (20 MARKS)

- a) Use truth table to prove that $(A + B) \cdot (A + C) = A + (B \cdot C)$. (4 Marks)
- b) Find the output of the following networks:

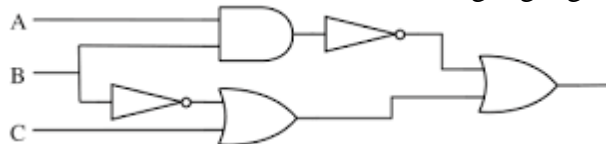


(2 Marks)



(4 Marks)

- c) Create the truth table for the following logic gate diagram.



(3 Marks)

- d) Find the derivatives of the following function:

i) $f(x) = e^{2x}(6x + 1)$

(2 Marks)

ii) $y = (x^2 - 9) \sin 3x$

(3 Marks)

iii) $y = \frac{x^4 - 3x + 6}{2 + 3x^3}$

(2 Marks)

QUESTION FIVE (20 MARKS)

- a) Evaluate the following integrals

i) $\int \frac{6x^5 - 1}{(x^6 - x + 1)} dx$

(3 Marks)

ii) $\int (x^3 - 6x)(2x + 3) dx$

(3 Marks)

iii) $\int 3x^2 e^{x^3 - 8} dx$

(3 Marks)

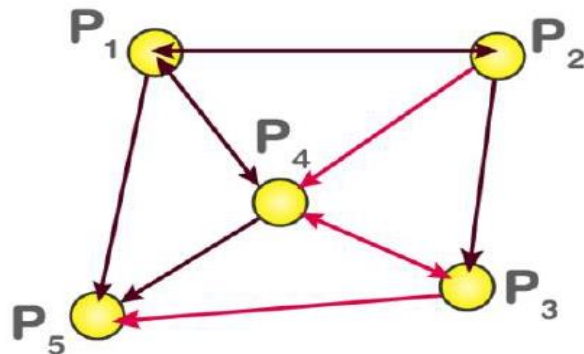
iv) $\int x^2 (2x^3 + 4)^3 dx$

(3 Marks)

v) $\int 2x \cos x^2 dx$

(3 Marks)

- b) Obtain the adjacency matrix representing the graph given below.



(5 Marks)