The Open University of Sri Lanka
B.Sc. in Information Technology Degree Programme
ADU4230 – Discrete Mathematics II
Final Examination - 2024/2025

Duration: Two hours

Date: 21-06-2025 **Time: 09.30 a.m. – 11.30 a.m.**

General Instructions

1. Read all the instructions carefully before answering the questions.
2. This paper consists of **TWO** sections; Section **A** and Section **B**. Section **A** is compulsory, and it consists of **SIX** Structured Essay Questions.
3. Section **B** consists of **FIVE** essay-type questions. Answer only **THREE** of them. Each question in Section **B** carries 100 marks.

SECTION A

Answer **ALL** the Questions.

1.

a) Check whether the matrix, $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ is orthogonal or not.

b) Reduce the given matrix into echelon form.

$$\begin{bmatrix} 0 & 3 & -6 \\ 3 & -7 & 8 \\ 3 & -9 & 12 \end{bmatrix}$$

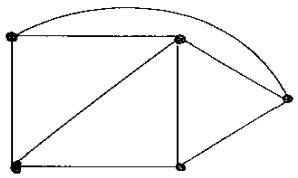
c) Find the greatest common divisor of $(5846,233)$ using the Euclidean algorithm.

d) Let G be a graph with vertices $V = \{A, B, C, D, E, F\}$. Draw the graph G corresponding to the following adjacency matrix.

$$\begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

e) Identify the type of graph given in question d) and justify your answer.

f) Determine whether the following graph is planar or not by using Euler's Theorem.



SECTION B

Answer **THREE** Questions **ONLY**.

2. Consider the matrix, $A = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 3 & 0 \\ -3 & 5 & 1 \end{bmatrix}$

a) Is the matrix A singular? Justify your answer.

b) Find the adjoint of the matrix A.

c) If the answer is 'no' for part a), find the inverse of A. If 'yes', argue the existence of the inverse of A.

d) Determine the rank of the matrix A. Justify your answer.

3.

a) Solve the following linear equation system using Cramer's rule.

$$x + 3y + z = 2$$
$$3x - 4y + z = 5$$
$$2y - z = 8$$

b) Discuss the nature of the solutions and solve the following system of equations using Gauss-Jordan Elimination method.

$$x + 2y = 8$$
$$3x + 4y = 10$$

4.

a) Do the following conversions.

i. Convert $(632)_8$ into binary.

ii. Convert $(A91)_{16}$ into decimal.

b) Solve the linear Diophantine equation: $416x + 96y = 800$.

c) Show that $89|2^{44} - 1$.

5.

a) Construct the graphs given below.

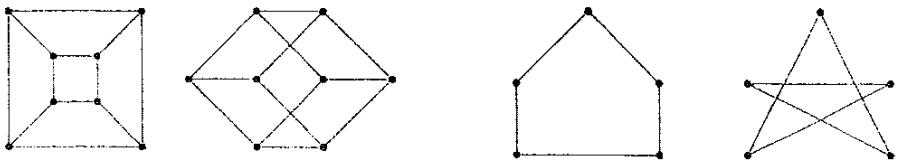
i. Peterson graph

ii. K_6 graph

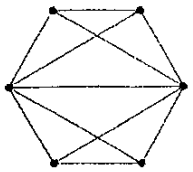
b) State the Handshaking lemma and hence find the total number of edges in K_6 graph.

c) Determine whether the following sets of graphs are isomorphic or not.

i. ii.



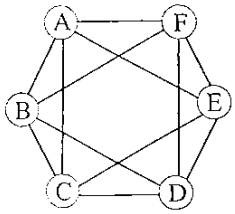
d) Find the complement of the following graph.



6.

a)

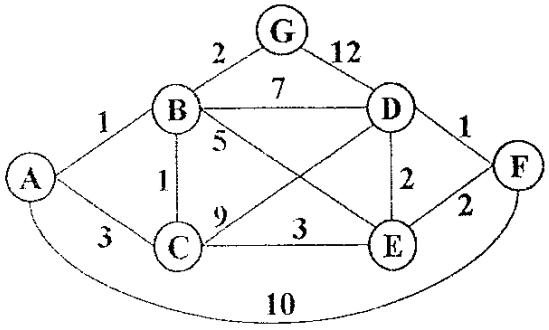
i. Draw the planar representation of the following graph.



ii. Is the above graph planar or not? Justify your answer.

iii. Discuss the existence of Euler's Theorem for the above graph.

b) Find the shortest path from vertex A to vertex F, using Dijkstra's algorithm.



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