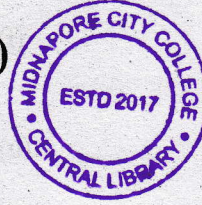# 2023

4th Semester Examination

MATHEMATICS (Honours)

Paper : SEC 2-T

[CBCS]

Full Marks : 40　　　　　　　　　Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.

[Graph Theory]

1. Answer any *five* questions :　　　　　　$2 \times 5 = 10$

　(a) Find the maximum and minimum number of edges of a simple graph with 12 vertices and 4 components.

　(b) Draw the complete graphs K_4, K_5 and K_6. Find the number of edges in the graph K_{14}, K_{15}.

　(c) Define a Spanning Tree. Hence find its branches and chords.

　(d) Define Rank and Nullity of a complete bipartite graph $K_{2,3}$.

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(2)

(e) Define degree sequence of a graph. Does there exist a graph with six edges and degree sequence (1, 1, 2, 4, 5, 5)?

(f) Define the terms eccentricity and centre in a tree with example.

(g) Define Hamiltonian of a Graph. Give an example of a Hamiltonian graph which is not an Eulerian Graph.

(h) Find the number of different spanning trees of a complete graph K_5.

2. Answer any *four* questions : 5×4=20

(a) Let G be graph of order 4. Its adjacency matrix is $A(G) = \begin{pmatrix} 1 & 1 & 0 & 2 \\ 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 3 \\ 2 & 1 & 3 & 0 \end{pmatrix}$.

Draw the graph and using the power of the adjacency matrix, examine whether G is connected or not.

(b) Define isomorphism in Graph theory. Write the conditions of isomorphism of two graphs. Examine the following two graphs whether they are isomorphic or not.

(3)
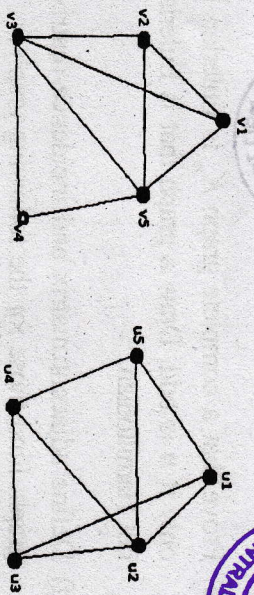
(c) Describe Warshall's Algorithm to find all the pairs of shortest path in the following graph.
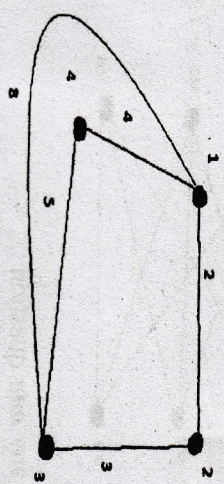
(d) A medical representative has to visit five stations namely A, B, C, D and E. He does not like to visit any station twice before completing his tour of all stations. The costs for going from one station to another are given below.

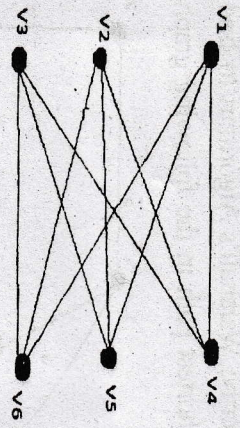|	A	B	C	D	E
A	-	5	8	4	5
B	5	-	7	4	5
C	8	7	-	8	6
D	4	4	8	-	8
E	5	5	6	8	-

Find the minimum cost of his tour of all stations.

(4)

(e) Prove that a complete graph K_n is Eulerian if and only if n is odd. Draw a graph that is Eulerian but not Hamiltonian.

(f) Define adjacent matrix and incidence matrix of a graph. Find those for the following graph :

3. Answer any *one* question : $10 \times 1 = 10$

(a) (i) Define the following terms : ring sum of two graphs and graph decomposition, deletion, fusion. Give example for each operations.

(ii) Describe the Dijktra's algorithm to find the shortest path from a specified vertex and find the shortest distance abroresence of the following graph.
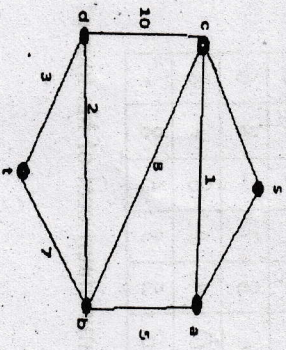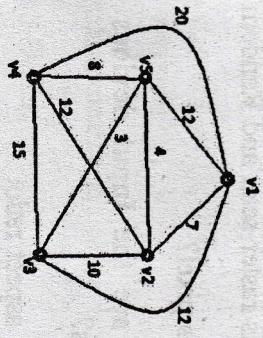

4+6

(5)

(b) (i) Draw the diagraph for the incidence matrix

$$I(G) = \begin{bmatrix} 0 & -1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & -1 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & -1 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & 0 \end{bmatrix}.$$

(ii) Draw the minimum spanning tree of the given graph by Kruskal Algorithm.

(iii) Prove that a connected graph G is an Euler graph if and only if all vertices of G are of even degree. 3+4+3

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(6)

OR

[Computer Graphics]

1. Answer any *five* questions out of eight questions :

    $2 \times 5 = 10$

    (a) Define Computer graphics.

    (b) What are the video display devices?

    (c) Define refresh buffer/frame buffer.

    (d) What do you mean by emissive and non-emissive displays?

    (e) What is raster scan and Random scan systems?

    (f) What is pixel?

    (g) What are the Input devices and Hard copy devices?

    (h) Define aspect ratio.

2. Answer any *four* questions out of six questions :

    $5 \times 4 = 20$

    (a) Explain in detail about the Line drawing DDA scan conversion algorithm.

    (b) Write down and explain the midpoint circle drawing algorithm. Assume 10 cm as the radius and co-ordinate as the centre of the circle.

(7)

    (c) Calculate the pixel location approximating the first octant of a circle having centre at (4, 5) and radius 4 units using Bresenham's algorithm.

    (d) Explain Ellipse generating Algorithm.

    (e) Explain Boundary Fill Algorithm.

    (f) Explain in detail the Sutherland-Hodgeman clipping algorithm with an example.

3. Answer any *one* question out of two questions :

    $10 \times 1 = 10$

    (a) Write short notes on Bezier curve and spline.

    (b) Write short notes on the following visible surface detection methods.

    (i) Back face detection

    (ii) Depth-Buffer method

    (iii) A-Buffer method

    _____

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(8)

OR

[Operating System : Linux]

1. Answer any *five* questions : 2×5=10

   (a) What is Linux?

   (b) What is the pwd command?

   (c) What is Shell?

   (d) How many types of Shells are there in Linux?

   (e) What is BASH?

   (f) What is a boot loader?

   (g) How do you open a command prompt when issuing a command?

   (h) Check of the file exists and display the number of lines, words and characters in the file. Display an appropriate message if the file is not present.

2. Answer any *four* questions : 5×4=20

   (a) Explain the following commands with examples chown, chmod.

   (b) What are the basic components of Linux?

   (c) What is the role of Linux kernel?

   (d) What is the difference between UNIX and LINUX?

(9)

   (e) Write a note on commands for disk space management.

   (f) Explain the pipe feature with examples.

3. Answer any *one* question : 10×1=10

   (a) (i) What are the different modes when using the vi editor? 3

   (ii) Write different file system types in Linux. Explain ls command with example. 2+2

   (iii) What are the features of the Linux OS? 3

   (b) (i) What is GUI? 2

   (ii) What does a nameless (empty) directory represent? Describe the root account. 3+2

   (iii) Which are the different file systems supported by Linux? 3

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