

B.A/B.Sc.4th Semester (Honours) Examination, 2022 (CBCS)

Subject: Mathematics

Course: BMH4SEC21

(Graph Theory)

Time: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

Candidates are required to write their answers in their own words as far as practicable.

[Notation and Symbols have their usual meaning]

1. Answer any five questions:

5×2 = 10

- (a) Define a Pseudograph. [2]
- (b) Write the degree sequence of the complete graph with three vertices. [2]
- (c) Find the number of edges in a complete graph having exactly 8 vertices. [2]
- (d) Define a regular graph. Draw a regular graph which is not a complete graph. [2]
- (e) Define: (A) Eulerian graph, and (B) Hamiltonian graph [2]
- (f) Define a tree. [2]
- (g) What do you mean by a shortest path between two vertices in a weighted graph? [2]

2. Answer any two questions:

2×5 = 10

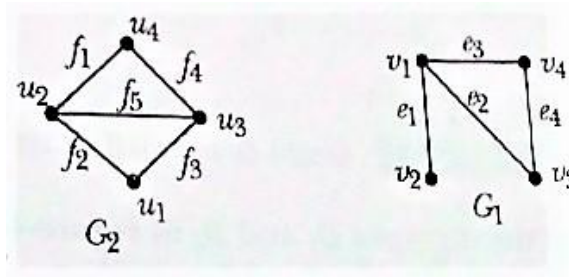
- (a) Show that the number of odd-degree vertices in a graph is always even. [5]
- (b) Define a complete bipartite graph. Find the number of edges in the complete bipartite graph $K_{m,n}$. When is $K_{m,n}$ regular? [1+2+2]
- (c) Show that if a tree T has exactly n vertices, then the number of edges in T is $n-1$. [5]
- (d) Find the values of n for which K_n is Eulerian. When is K_n Hamiltonian? [3+2]

3. Answer any two questions:

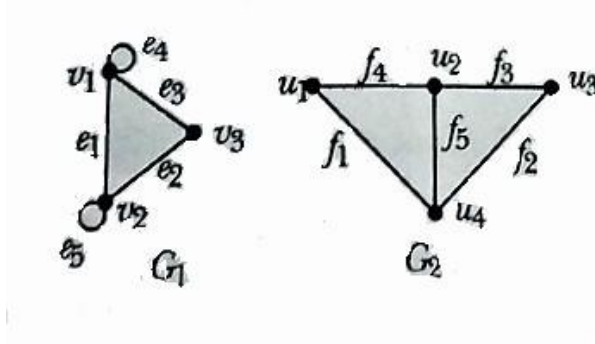
2×10 = 20

- (a) (i) Does there exist a simple graph with the following degree sequences? [6]
Explain in each case.
(A) (5, 5, 4, 2, 2, 2)
(B) (3, 2, 1, 0)
- (ii) Define a cycle and a circuit. Show that every cycle must also be a circuit. [2+2]
- (b) (i) Are the following graphs G_1 and G_2 isomorphic to each other? Give reasons in each case:

(A)



(B)

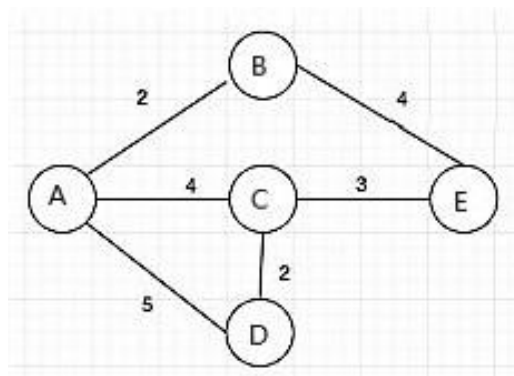


[3+3]

(ii) Let G be a connected graph which is Eulerian. Show that all the vertices of G are of even degree. [4]

(c) (i) Write the Adjacency and incidence matrices for the complete graph of 6 vertices (K_6) with any particular vertex and edge labellings of your choice. [5]

(ii) Apply Dijkstra's Algorithm to find the shortest path between vertices A and E of the following weighted graph. The edge weights are indicated along the edges.



[5]

(d) Write short notes on:

(i) The Konigsberg's Bridge Problem

(ii) The Travelling Salesman Problem

[5+5]

B.A/B.Sc. 4th Semester (Honours) Examination, 2022 (CBCS)

Subject: Mathematics

Course: BMH4SECI22

[Operating System (Linux)]

Time:2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

Candidates are required to write their answers in their own words as far as practicable.

[Notation and Symbols have their usual meaning]

1. Answer any five questions:

5×2 = 10

- (a) Define operating system. [2]
- (b) Describe any two features of Linux operating system. [2]
- (c) Describe any one security feature of Linux operating system. [2]
- (d) What is the purpose of execute (+x) permission for directory? Explain. [2]
- (e) What do you mean by Linux distribution? [2]
- (f) What do you mean by system call? [2]
- (g) What is the importance of an editor? [2]

2. Answer any two questions:

2×5 = 10

- (a) (i) What do you mean by start up scripts? [1]
- (ii) Briefly describe the role Shell in the Linux architecture. [4]
- (b) (i) What are the purposes of permissions of a file? [2]
- (ii) Briefly describe how to change the read permission of a file for different types of users with suitable examples. [3]
- (c) (i) What is a file? [2]
- (ii) Discuss different file management commands available in Linux. [3]
- (d) (i) What do you mean by file system? [1]
- (ii) Briefly describe Ext2 file system. [4]

3. Answer any two questions:

2×10 = 20

- (a) (i) What is normal mode in 'vi' editor? [2]
- (ii) Briefly describe the different cursor movement commands of 'vi' editor. [8]
- (b) (i) What do you mean by IPC? [2]
- (ii) Briefly describe the usage of pipe() system call with suitable examples. [8]
- (c) (i) What does fork() system call return? [2]
- (ii) Discuss exec() system call with suitable examples. [8]
- (d) (i) What do you mean by system process? [2]

(ii) Briefly discuss the history of Linux.

[8]

B.A./B.Sc. 4th Semester (Honours) Examination, 2022 (CBCS)

Subject: Mathematics

Course: BMH4SEC23

(MATLAB Programming)

Time:2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

Candidates are required to write their answers in their own words as far as practicable.

[Notation and Symbols have their usual meaning]

1. Answer any five questions:

5×2 = 10

- (a) Using the colon operator and also the linspacefunction, write down the MATLAB command to create the following row vectors: -5, -4, -3, -2, -1. [2]
- (b) Which would you normally use for a matrix in MATLAB: Length or size? Why? [2]
- (c) Write down the MATLAB command to create a 3×3 matrix using MATLAB command and the write down the MATLAB command to display the first row on the screen. [2]
- (d) Write down the MATLAB command to create a 3×5 matrix of random real numbers. [2]
- (e) Write down short note on Script file. [2]
- (f) Write down the MATLAB command to compute the following quantity [2]
- $$\frac{(\sqrt{11} - 1)}{5^2 - 3^2} + \frac{5^7 \log_{10}(e^5)}{\pi\sqrt{110}} + \log_e e^4 + \sqrt{13}$$
- (g) Write down the MATLAB command to find the sum of the integers from 1 to 100. [2]

2. Answer any two questions

2×5 = 10

- (a) Write down the MATLAB command to create two different vectors of the same length of 10. Then write down the MATLAB command to perform following operations: [2+3×1]
- (i) addition.
- (ii) element-by-element multiplication.
- (iii) element-by-element division.
- (b) Write down the MATLAB command to find the sum of all the prime numbers less than 10 000. [5]
- (c) Write short notes on the MATLAB commands 'rot90' and 'rot270' with example. [5]
- (d) (i) Write down short note on 'while-loop' in MATLAB with an example. [2]

- (ii) Write down the MATLAB command to solve the equation $5x^2 + 3x + 9 = 0$. [3]

3. Answer any two questions:

2×10 = 20

- (a) (i) Let $= \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 9 & 0 & 1 & 5 & 0 & 3 & 9 & 7 \\ 2 & 0 & 4 & 1 & 7 & 9 & 0 & 1 \\ 0 & 6 & 2 & 5 & 8 & 1 & 3 & 0 \\ 8 & 7 & 6 & 0 & 0 & 3 & 2 & 1 \end{pmatrix}$. [3+2]

Write down the MATLAB command to create a 3×4 matrix from the 1st, 3rd and the 5th rows, and the 1st, 2nd, 4th and 8th columns of the matrix A, and to form a 16 element row-vector from the element of the 1st and 5th rows of the matrix A.

- (ii) Write down the MATLAB command to solve the system of equation [5]

$$5x_1 + x_2 - 3x_3 = 4$$

$$2x_1 + 3x_2 - x_3 = 7$$

$$5x_1 + 4x_2 - 2x_3 = 11.$$

- (b) Write down the MATLAB command to create a 3×5 matrix of random integers within the range from -10 to 10. Write down the MATLAB command to perform each of the following: [2+4×2]

- (i) Find the maximum value in each column.
- (ii) Find the maximum value in each row.
- (iii) Find the maximum value in the entire matrix.
- (iv) Count how many elements are positive.

- (c) (i) Write a simple script file in MATLAB to find dot product and cross-product of 2 vectors $a = \hat{3}j - \hat{k}$ and $b = \hat{i} - 3\hat{j}$. [5]

- (ii) Write down the MATLAB command to determine the eigenvalues and eigenvectors of $A = \begin{pmatrix} 4 & 2 & -3 \\ -1 & 1 & 3 \\ 2 & 5 & 7 \end{pmatrix}$. [3]

- (iii) Write down short note on 'do-loop' in MATLAB with an example. [2]

- (d) Write down the MATLAB command to plot the following functions on the same graph for $0 \leq x \leq 2\pi$ using the plot function and also add a legend and label of the axes. [5]

(a) $\sin^2 \frac{x}{2}$, (b) $\cos^2 \frac{x}{2}$, (c) $\sin 2x$.

- Write down the MATLAB command to calculate $\cos(x)$ for given x in a script file. [5]