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TBC–206

B. C. A. (SECOND SEMESTER) END SEMESTER EXAMINATION, June, 2023

DISCRETE MATHEMATICAL STRUCTURE AND GRAPH THEORY

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any ***two*** sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$, show that : (CO1)

$$A^2 - 4A - 5I = O.$$

P. T. O.

(b) Define the following with proper example. (CO1)

(i) Scalar matrix

(ii) Transpose of a matrix

(iii) Hermitian matrix

(iv) Determinant of a matrix

(c) Determine the characteristic roots and the corresponding characteristic vectors of the matrix : (CO1)

$$A = \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$$

2. (a) Draw the logic diagram for the following : (CO2)

(i) $xyz + x'yz + xy'z'$

(ii) $(x + y'z)(x + y + z')$

(b) Use Karnaguh map to simplify the following expression : (CO2)

(i) $X = A'B' + A'B + AB$

(ii) $X = A'B'C + AB'C + A'BC + ABC + ABC'$

(c) Complement the following experession by applying De-Morgan's theorem : (CO2)

(i) $((A'+C).(BD'))'$

(ii) $(A'+B'C)'$

3. (a) Explain Konigsberg bridge problem.(CO3)

(b) Explain any *two* applications of graph theory. (CO3)

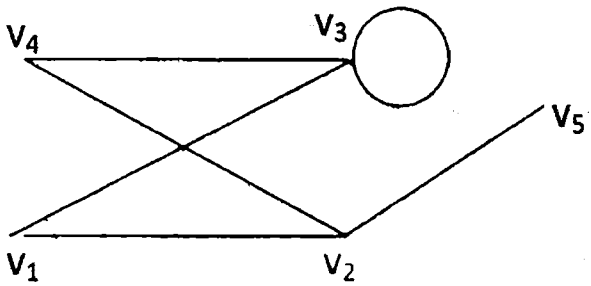
(c) For the given graph, find the following : (CO3)

(i) Order and size of the graph

(ii) Degree of each vertex

(iii) Pendant vertex

(iv) Matrix for the graph



4. (a) Write short notes on the following : (CO4)

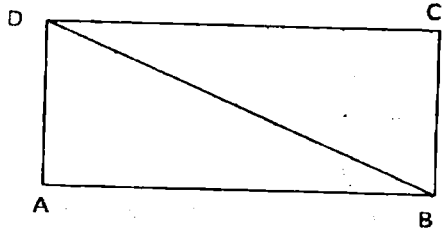
(i) Planar graph

(ii) Cut set and cut vertex

(iii) Component and Fragment

(iv) Indegree and Outdegree in a directed graph

(b) Define chromatic polynomial and find the chromatic polynomial of the given graph with the help of Decomposition theorem : (CO4)



(c) What is the colouring of graph ? Define chromatic number and also find the chromatic number of a complete graph with 3 vertices. (CO4)

5. (a) Define the following with example : (CO5)

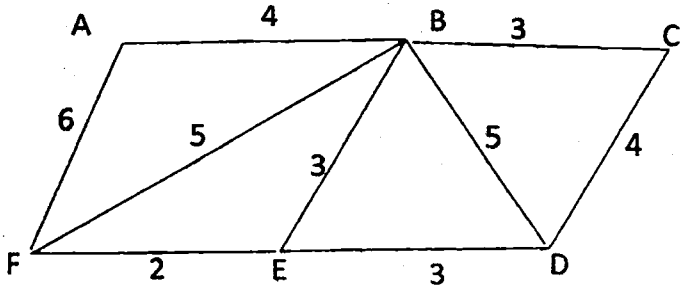
(i) Rank and nullity in a graph G

(ii) Rooted tree

(iii) Full binary tree

(iv) Height of a binary tree

(b) Define the minimal spanning tree and also find the minimal spanning tree for the given graph using Kruskal's algorithm : (CO5)



(c) Define fundamental circuits. Draw all possible fundamental circuits of the given graph : (CO5)