Nirma University

Institute of Technology

Semester End Examination (IR), May 2022

B. Tech. in Computer Science and Engineering, Semester-VI

2CSDE56: GRAPH THEORY

Roll/
Exam No

Supervisor's initial
with date

Time: 3 Hours

Max Marks: 100

Instructions:
1. Attempt all questions.
2. Figures to the right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.
5. Assume necessary data wherever required and state the assumptions.

SECTION – I   50 Marks
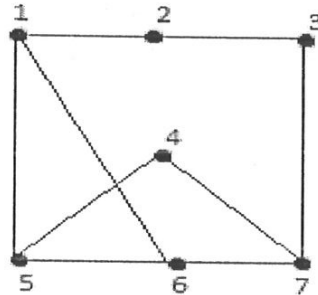
Q-1. Do as directed.   **[16]**

A) Define following terms for directed graphs with proper example: **[06]**
CO1,BL1   1) Central tree
            2) Null graph
            3) Isomorphic graphs

B) Find out the minimum spanning tree for the following graph using   **[05]**
CO1,BL3 Prim's algorithm.
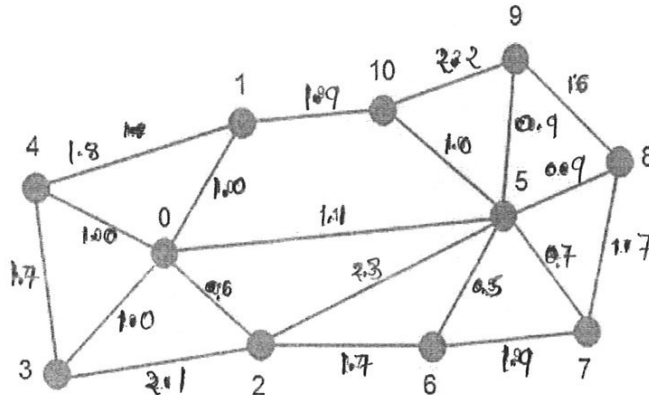
C) Give an example to show that nullity of a graph is unaffected whether   **[05]**
CO1,BL2 a vertex of degree two is inserted to a graph or removed from a graph.

Q-2. Answer the following.   **[16]**

A) Find out the distance between two spanning trees T1 and T2 of a   **[05]**
CO2,BL3 graph G as shown below.

G   T1   T2
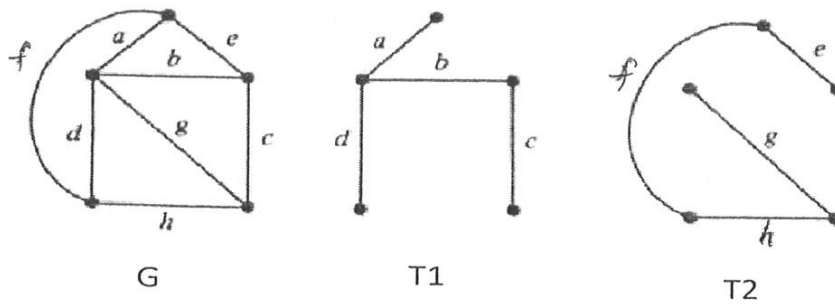
B) Apply elementary reduction to a below given graph and check **[05]**
CO2,BL4 whether it is planar or not.

**C)** Find the geometric dual of a graph given below. **[06]**
CO2,BL3
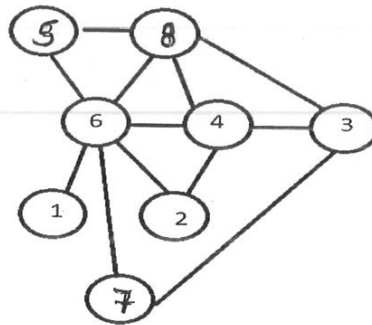
OR

C) Define necessary condition for two graphs G1 and G2 to be **[06]**
CO2,BL2 combinatorial duals of each other. Explain with proper example.

Q-3. Do as directed. **[18]**

A) Is the degree sequence S= {7, 6, 6, 4, 4, 3, 2, 2} graphical or not? **[03]**
CO3,BL3

B) Calculate number of edges of a connected planar graph G with 10 **[03]**
CO3,BL5 vertices and number of edges on each face is three.

C) Prove with indirect proof technique that K3,3 does not have dual. **[03]**
CO3,BL1

D) Find out all the fundamental circuits (semi or direct) with respect to **[03]**
CO3,BL2 the spanning tree given for the following graph.
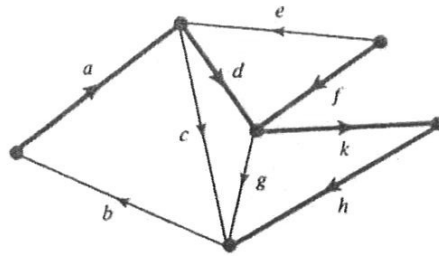
E) Explain regularization of a planar graph with proper example. **[06]**
CO3,BL4

OR

E) The graph for five senators who are member of three committees is **[06]**
CO3,BL4 shown below. Find the deficiency number for the graph.

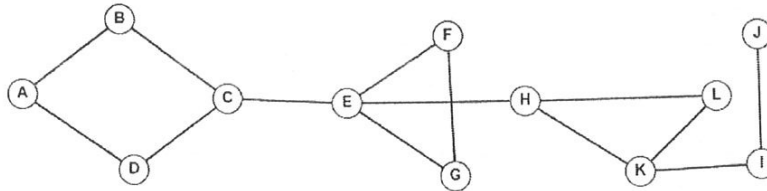Committees   Senators
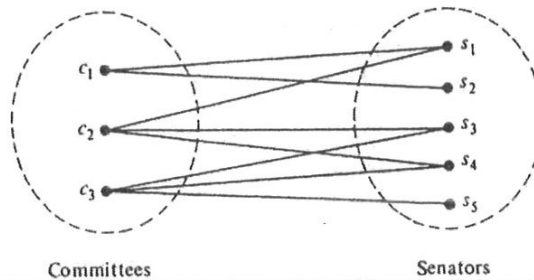
SECTION-II   50 Marks

Q-4. Answer the following. **[16]**
A) Perform the 1-isomorphism operation on the following graph and **[05]**
CO2,BL2 obtain all blocks.

B) Prove the following: **[05]**
CO2,BL3 The ring sum of any two cut-sets in a graph is either a third cut-set
or an edge-disjoint union of cut-sets.

C) A simple connected graph contains 7 vertices and 14 edges with the **[06]**
CO2,BL4 degree of the vertices as follows D = {3,3,4,4,4,4,6}. Construct the
graph G and find the following
- vertex connectivity
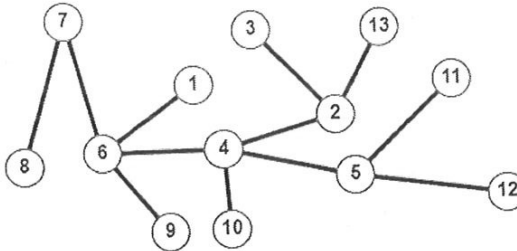- edge connectivity.
- maximum possible vertex connectivity

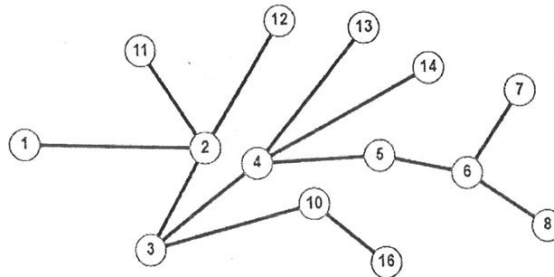Write a set corresponding to each of the above values.

Q-5. Answer the following. **[16]**
A) Obtain the Prufer sequence 'S' for the following graph: **[05]**

CO3,BL5

CO2,BL5 **B)** Find the radius, diameter, and center for the following graph: **[06]**

OR

B) Derive a formula to find the total number of pendant vertices in a full **[06]**
CO2,BL3 binary tree. Using the derived formula find the following
    i.   Number of vertices if there are 14 pendant vertices
    ii.   Number of pendant vertices if there are 11 vertices.

C) Define the crossing of a graph. Find the crossing number of **[05]**
CO2,BL1 Kuratowski's graphs with a neat sketch for the same.

Q-6. Do as directed. **[18]**
A) List the fundamental requirements that need to be satisfied by the **[06]**
CO1,BL1 distance metric between two vertices of a given graph. Illustrate with
a suitable example.

B) Construct a m-ary rooted tree structure that can be used to find **[06]**
CO1,BL3 monotonically decreasing subsequences from the following given set
of numbers: D = { 4, 9, 11, 7, 3, 6, 2, 8, 1}
OR

B) The probability of occurrences of 6 characters in a sentence is given **[06]**
CO1,BL4 by 0.04, 0.20, 0.25, 0.16, 0.05 and 0.3. Find the minimum weighted
path length by constructing a binary tree.

C) Find all minimal dominating sets for the following graph: **[06]**
CO1,BL5