

Q.P. Code:00000216

[Time:2.30 Hrs]

[ Marks:75 ]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
  2. Figures to the right indicate full marks.
  3. Students answering in the regional language should refer in case of doubt to the main text of the paper in English.

Q.1 Attempt any 4 questions: 20M

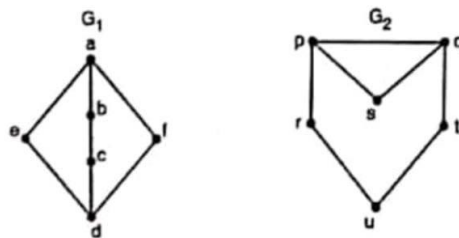
- a) How Combinatorics and Graph Theory relate with each other? Give an example.
- b) State and prove binomial theorem.
- c) Define first principle of mathematical induction.
- d) Prove that integer 'n' can be expressed as a product of positive primes,  $n \geq 2$ .
- e) Explain multinomial coefficients.
- f) What is combinations? Prove the formula.

Q.2 Attempt any 4 questions: 20M

- a) Draw a graph with adjacency matrix A.

$$A = \begin{bmatrix} 0 & 2 & 1 & 2 & 0 \\ 2 & 0 & 1 & 2 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 2 & 2 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

- b) Determine whether following graphs are isomorphic or not.

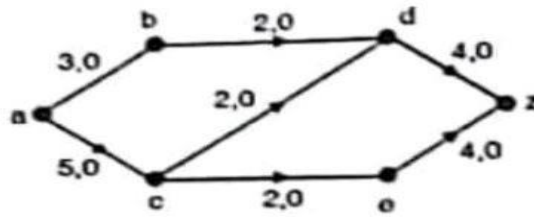


- c) Define and explain Spanning Subgraph with an example.
- d) Define loops and multiple edges.
- e) Define multigraphs with the help of an example.
- f) State Ramsey's theorem.

Q.3 Attempt any 4 questions: 20M

- a) What are the basic notations and terminologies used in network flow.
- b) Explain flows and cuts.
- c) Explain Augmenting path with example.
- d) Explain Ford-Fulkerson labelling algorithm.

e) Find maximum flow of following network: -



f) Explain the coloring of vertices.

Q.4

Attempt any 3 questions:

15M

a) Explain what is 'Sudoku Puzzle'.

b) Prove that by mathematical induction,

$$2 + 5 + 8 + \dots + (3n - 1) = \frac{n(3n + 1)}{2}$$

c) Draw all possible non isomorphic simple graphs with 4 vertices.

d) What is Graph Colouring?

e) What is chain partitioning? Explain with example.

f) Explain matching in Bipartite Graphs.