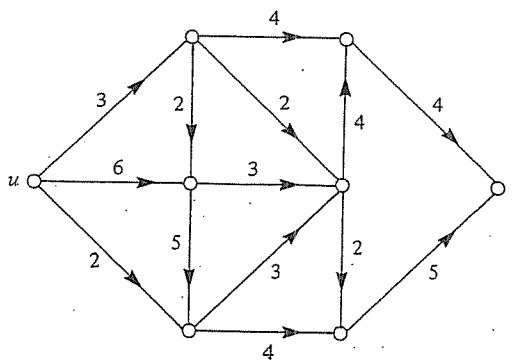


1. Explain the following terms in Graph Theory. (30 points, 5 points each)
  - (a) Isomorphic Graphs
  - (b) Diameter of a graph
  - (c) n-connected graphs
  - (d) Bipartite graphs
  - (e) Chromatic number of a graph
  - (f) Adjacency matrices of a graph
  
2. Construct a graph which satisfies given constraints. (40 points, 8 points each)  
(Explain your answers for full credits!)
  - (a) A graph with diameter 15 and radius 10.
  - (b) A 3-regular graph of order 10 with no cycles of length 3 and 4.
  - (c) A graph of order 20, size 100 with no triangles (3-cycles).
  - (d) A tournament of order 10 with 10 different out-degrees from 10 vertices.
  - (e) A graph  $G$  with  $\delta(G) = 7$ ,  $\kappa'(G) = 5$  and  $\kappa(G) = 3$ .
  
3. Find all non-isomorphic graphs of order 5. (10 points)
  
4. Find the maximum flow of the following network. (10 points)  
(Explain your answer.)



5. Prove two of the following statements for 30 points. (15 points each)
  - (a) A connected graph  $G$  has an Eulerian circuit if and only if each vertex of the graph has an even degree.
  - (b) If the degree sum of any two non-adjacent vertices is at least the order ( $\geq 3$ ) of  $G$ , then  $G$  has a Hamilton cycle.
  - (c) If  $G$  is critically  $n$ -chromatic, then  $\delta(G) \geq n - 1$ .