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M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)

Term-End Examination

December, 2013

MMTE-001 : GRAPH THEORY

Time : 2 hours | *Maximum Marks : 50*
Weightage : 50%

Note : *Answer question number 1 which is* **compulsory**. *Attempt* **any four** *from the remaining six.*

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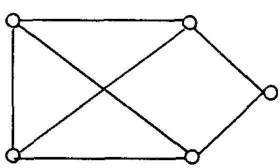
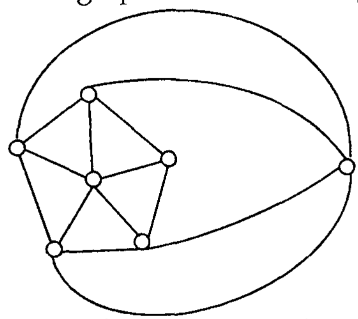
1. State , giving justification or illustrations, whether each of the following statements is **true or false :**
   (a) Any two graphs with the degree sequence (3,2,2,2,1) are isomorphic. **5x2=10**
   (b) "Any tree is bipartite".
   (c) The following graph is isomorphic to its complement.



   (d) Every Hamiltonian graph is 2- connected.
   (e) If h is a k- critical graph, $\delta(h) > k-2$.

2. (a) Show that a cubic graph with a cut edge contains atleast 10 vertices. **4**
   (b) Draw an Eulerian graph with 8 vertices and 14 edges. Justify why your example is Eulerian. **3**

(c) Define the dual of a planar graph. Draw the dual graph of the following graph. **3**



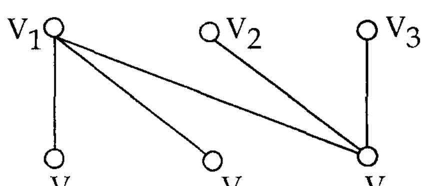
3. (a) Does there exist a planar graph with 6 vertices and 9 edges. If no, give justifications. If yes, draw such a graph and give the number of farer in your graph. **3**

(b) In the graph given below, give the following with justification **4**

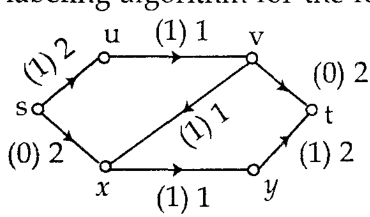
(i) A matching of maximum size

(ii) A vertex cover of minimum size

(iii) An independent set of vertices of maximum size



(c) Illustrate all the steps of the Ford- Fulkerson labeling algorithm for the following graph. **3**



4. (a) Define independence number. Find the independence number of **4**
   (i) The complete graph K_n
   (ii) The complete bipartite graph $K_{m,n}$

   (b) Consider weights (6,2,8,9,3,4,7). Draw a balanced tree, keeping all the weights at the leaf of the balanced tree. **4**

   (c) Give an example of a graph G with chromatic number 4 **2**

5. (a) State a necessary condition for a graph to be Hamiltonian. Is it sufficient ? If yes, give proof. If no, give example. **4**

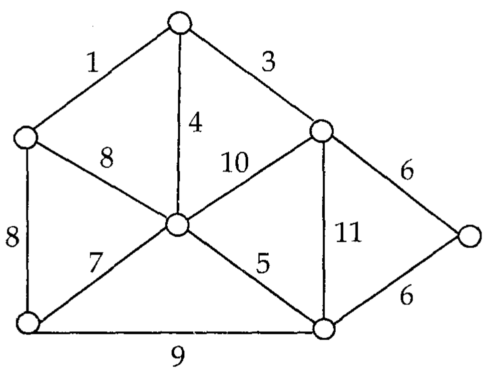
   (b) Check whether the following list is graphic using Havel-Hakimi algorithm (3,3,4,4,4,4). **4**

   (c) Is it true that complete bipartite graphs are Hamiltonian. Explain . **2**

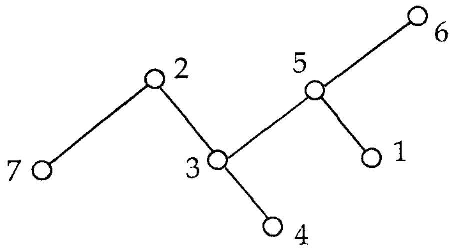
6. (a) Give an example of a graph G with **4**
   (i) $k(G)=k'(G)=\delta(G)$
   (ii) $k(G)<k'(G)<\delta(G)$

   (b) Let G be an acyclic graph with n vertices and $n-1$ edges. Show that G is connected. **3**

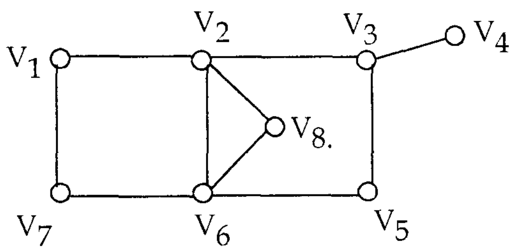
   (c) Find the minimum spanning tree in the following graph. **3**



7. (a) Explain the Priifer code of a tree. Find the Priifer code of the following tree. **4**



(b) Draw the incidence matrix and adjacency matrix of the following graph. **3**



(c) Check whether the following graph is bipartite. If it is bipartite, give a bipartition. If it is not, explain your answer. **3**