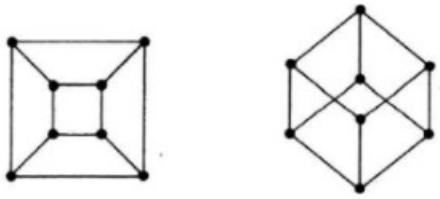
Indian Institute of Engineering Science and Technology, Shibpur
B.Tech. - M.Tech. Dual Degree 5^{th} Semester Examinations (Mid Sem), October, 2021
Graph Algorithms (CS 3104)

Full Marks: 30 **Time: 45 minutes**

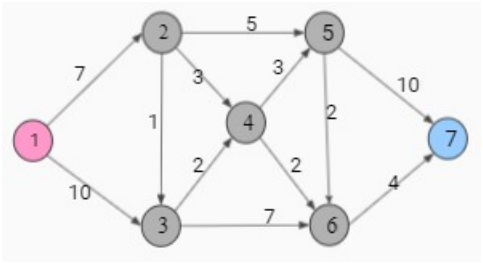
Answer any three.
Do all parts of a question together. Do not mix up answers to parts of different questions in the answer script.

1. (a) Show that the maximum number of edges in a simple graph with n vertices is $n(n-1)/2$.
   (b) Verify that the two graphs in the following Figure are isomorphic. Label the corresponding vertices and edges.



[5 + 5 = 10]

2. (a) Consider the following directed, weighted graph. The weights on the edges show the capacity of the edges. Compute the maximum flow from the source s to the sink t using the Ford-Fulkerson algorithm. At each step, clearly show the flow. Here, source node is 1 and sink node is 7.

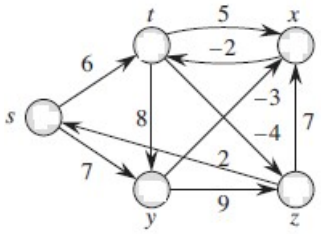


[10]

3. (a) Using Kuratowski's theorem, show that the Petersen's graphs are non-planar.
   (b) Prove, that every planar graph, which has no loops or multiple edges, and v vertices ($v \geq 3$) and e edges then $e \leq 3v - 6$

[5 + 5 = 10]

4. (a) Run the Bellman-Ford algorithm (for finding Single-source shortest-path) for the following directed graph using the vertex, z as source. In each pass relax the light edges and show the d and π values after each passes.



[5 + 5 = 10]