CS 5890 Machine Learning with Graphs (Fall '22)

Assignment 1

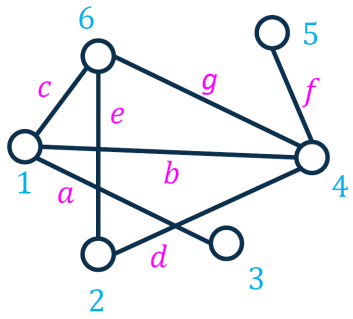
Due Date: 11:59 pm, Wednesday, September 14, 2022

Note: You can use Python (with Networkx library) for solving these problems. Please submit *.py* or *.ipynb* file. Please use necessary commenting in your code for identifying the questions you are answering. Your submission will contain two code files (p1.<file_type>, p2.<file_type>) and on doc file (a1.docx or a1.PDF). The .docx or .pdf file will contain the answers of the following problems (you can paste screenshots of your program outputs). Please submit all **three** of your files in the corresponding assignment folder of Canvas.

Name:

ID:

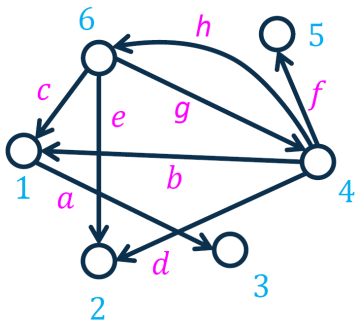
Problem 1. (40 points) Store the following undirected graph $G(E,V)$ in memory using appropriate node and edge labels.



Please answer the following questions.

1. What are the degrees of node 1 and 4?
2. What is the shortest path from node 3 to 5?
3. What is the edge list representation of $G(E,V)$?
4. What is the adjacency list of $G(E,V)$?
5. What is the adjacency matrix A of $G(E,V)$?
6. What is the degree matrix D of $G(E,V)$?
7. What is the Laplacian matrix L of $G(E,V)$?
8. What is the incidence matrix C of $G(E,V)$?
9. What is the relationship between matrices A , D , and C ?
10. Please draw the line graph of $G(E,V)$.

Problem 2. (60 points) Store the following directed graph $G(E,V)$ in memory using appropriate node and edge labels.



Please answer the questions.

1. What are the in-degrees and out-degrees of node 2 and 6?
2. What is the shortest path from node 4 to 3?
3. Is the graph a strongly connected graph?
4. What is the largest subgraph that is strongly connected?
5. Is the graph a directed acyclic graph?
6. What is the diameter of this graph?
7. What is the edge list representation of $G(E,V)$?
8. What is the adjacency list of $G(E,V)$?
9. What is the adjacency matrix A of $G(E,V)$?
10. What are the out-edge incidence matrix B and the in-edge incidence matrix E of $G(E,V)$?
11. What is the relationship between matrices A , B , and E ?
12. Please draw the line graph of $G(E,V)$.
13. What is the adjacency matrix M of the line graph of $G(E,V)$?
14. What is the relationship the matrices M , B **,** and E?