Design and Analysis of Algorithm (CS 412)
Instructor: Dr. Ayesha Enayet
Date: _____
CS 6th

SIS ID:_____ Name:_____

Instructions: Attempt all the questions. Use of device(s) is not allowed. Use a Blue/Black pen.

A. [Prove/Disprove] The Bellman-Ford algorithm can be utilized/modified to solve the All-pairs shortest-paths problem (the shortest path from u to v for every pair of vertices u and v). [1]

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B. Propose an algorithm to find single-source shortest paths in directed acyclic graphs. Please note that the edge weights can be negative. [1]

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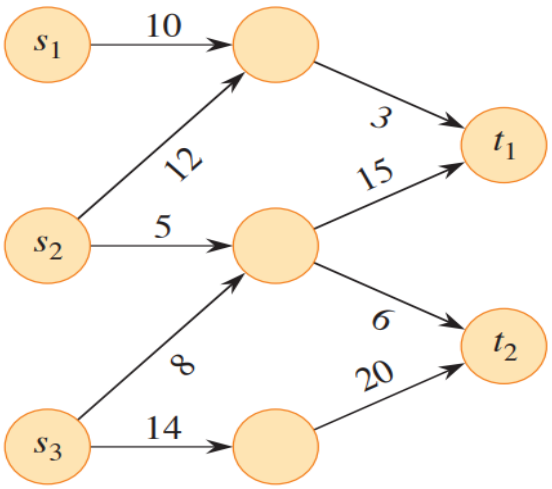
C. The worst-case complexity of Bellman-ford algorithm is _____ [1]

D. To map the following graph to flow graph with dedicated source (S) and source node (T), what should be the ideal weights for the edges (S,S1), (S,S2), (S,S3), (t1,T), (t2,T)? Please note that the weight should be the same for all five edges. [1]



E. A university is assigning **teaching assistants (TAs) to courses** for the upcoming semester. Each TA can be assigned to at most one course, and each course requires exactly one TA. The university wants to maximize the number of TA-course assignments based on the following preferences: [1]

- **TAs:** Alice, Bob, Charlie, David
- **Courses:** Data Structures, Algorithms, AI, ML
- **Preferences:**
  - Alice is willing to teach Data Structures and AI.
  - Bob is willing to teach Algorithms and ML.
  - Charlie is willing to teach Data Structures and ML.
  - David is willing to teach AI and ML.

Tasks:

1. **Construction: Model the problem using a graph**.
2. **Propose an algorithm** to maximize the number of TA-course assignments. Dry run the proposed algorithm on the graph from Task 1.