

**CS 430 – Spring 2023**  
**INTRODUCTION TO ALGORITHMS**  
**HOMEWORK #5**  
**DUE 23:59 April 20 (Thursday)**

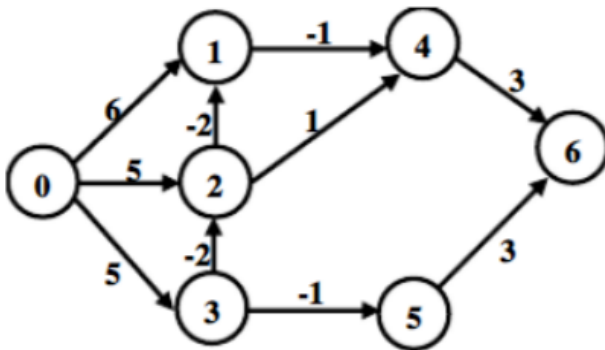
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- Assignment Instruction

- Teamwork is NOT allowed.
- Submit your answers in PDF version to the Blackboard.
- No late submission accepted.
- All solutions should be explained.

**!! Any unrecognized handwriting causing ambiguity will result in a zero to your solutions!!**

1. (5 points) Refer to the weighted directed graph below and adopt the Bellman-Ford to find shortest paths sourced from **vertex 0** to all other vertices. Answer the following questions.



- 1(a). (1pt) Present the adjacent matrix.

- 1(b). (1pt) Demonstrate the procedure of shortest paths disclosure in the following table by adopting Bellman-Ford algorithm. Use row 1 and 2 as examples. You may add more rows when necessary.

Round--k	Dist <sup>k</sup> [0]	Dist <sup>k</sup> [1]	Dist <sup>k</sup> [2]	Dist <sup>k</sup> [3]	Dist <sup>k</sup> [4]	Dist <sup>k</sup> [5]	Dist <sup>k</sup> [6]
<b>1</b>	<b>0</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>∞</b>	<b>∞</b>	<b>∞</b>
<b>2</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>∞</b>
3							
4							
5							
6							

1(c). (3pts) Implement the function to find all shortest paths from 0 to other vertices by Bellman-Ford. Your implementation should print the shortest paths. (Preferred Java or C++). Run your code and present the shortest paths found by your implementation.

2. (5pts) Argue that if all edge weights of an undirected graph are positive, then any subset of edges that connects all vertices and has minimum total weight must be a tree.

3. (5pts) Given an unweighted undirected graph G, and a vertex pair u and v, please give out a pseudo code returning T if v is reachable from u. Otherwise return F. Analyze the time complexity of your algorithm.

4. (5pts) Some students enroll in some events in athletics. Below shows students names and their enrolled events.

Name	Events
Zach Williams	A B E
Jennifer Hopkins	C D
Ivan Green	C E F
Douglas May	D F A
Katherine Nojwoi	B F

But some events may be held with a time conflict. To find out if each student could succeed participating in all events he/she enrolls in, we refer to the graph  $G$  below. In  $G$ , if two events have no time conflict, they are connected by an edge. Give out a pseudo code to return T if a student's enrolled events have no conflict and F otherwise.

