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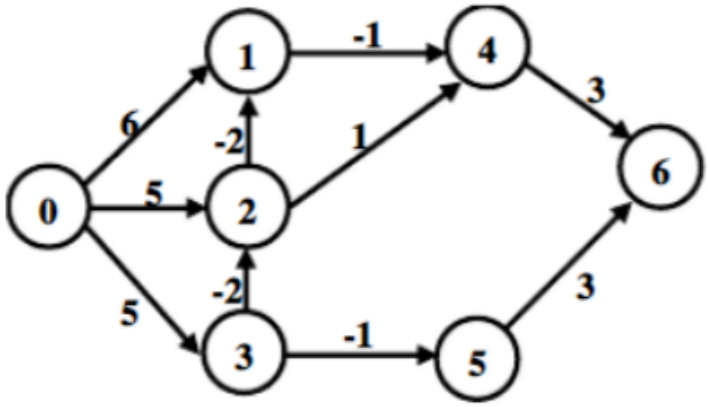
CS 430 – Fall 2021
INTRODUCTION TO ALGORITHMS
HOMEWORK #5
DUE 23:59 THURSDAY, DEC. 2

Ethics: Any behavior on any homework or exam that could be considered copying or cheating will result in an immediate zero on the assignment for all parties involved and will be reported to academichonesty@iit.edu See the IIT Code of Academic Honesty, https://web.iit.edu/student-affairs/handbook/fine-print/code-academic-honesty

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

!! Any unrecognized handwriting will cause ambiguity and 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	$Dist^k[0]$	$Dist^k[1]$	$Dist^k[2]$	$Dist^k[3]$	$Dist^k[4]$	$Dist^k[5]$	$Dist^k[6]$
1	**0**	**6**	**5**	**5**	**∞**	**∞**	**∞**
2	**0**	**3**	**3**	**5**	**5**	**4**	**∞**
3							
4							
5							
6							

see below

edges: (0,1), (0,2), (0,3), (1,4), (2,1), (2,4), (3,2), (3,5), (4,6), (5,6)

1.a

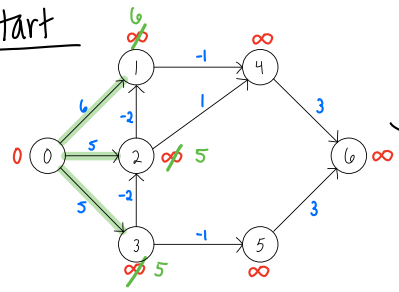
u \ v	0	1	2	3	4	5	6
0	∅	6	5	5	∅	∅	∅
1	∅	∅	∅	∅	-1	∅	∅
2	∅	-2	∅	∅	1	∅	∅
3	∅	∅	-2	∅	∅	-1	∅
4	∅	∅	∅	∅	∅	∅	3
5	∅	∅	∅	∅	∅	∅	3
6	∅	∅	∅	∅	∅	∅	∅

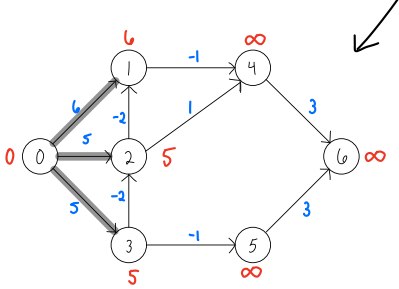
if $d(u) + w(u,v) < d(v) \xrightarrow{\text{update}} d(v) = d(u) + w(u,v)$

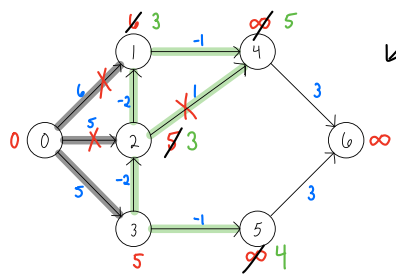
1.b.

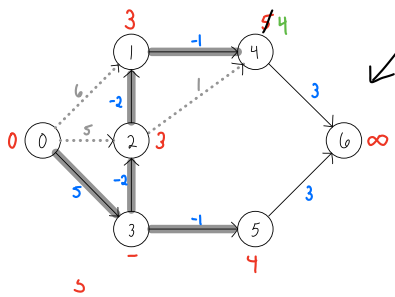
round (k)	$d(0)_k$	$d(1)_k$	$d(2)_k$	$d(3)_k$	$d(4)_k$	$d(5)_k$	$d(6)_k$
0	0	∞	∞	∞	∞	∞	∞
1	0	6	5	5	∞	∞	∞
2	0	3	3	5	5	4	∞
3	0	3	3	5	5	4	7
4	0	1	3	5	2	4	7
5	0	1	3	5	2	4	5
6	0	1	3	5	0	4	5
7	0	1	3	5	0	4	3

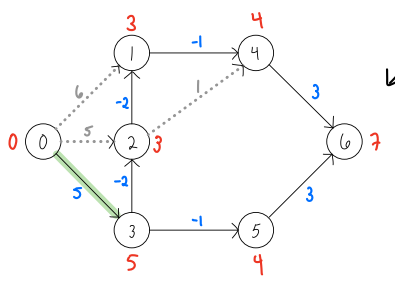
start

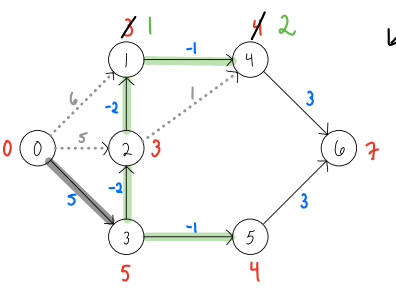


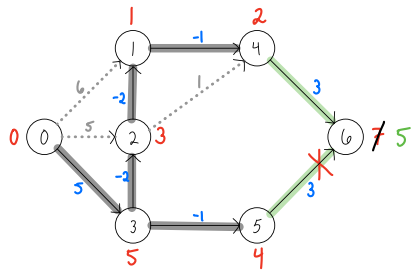


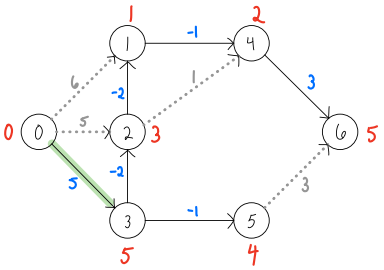


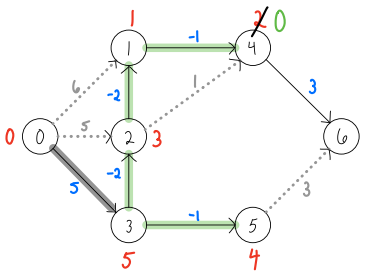


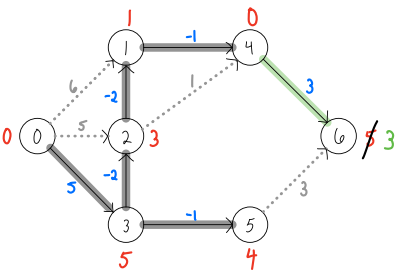


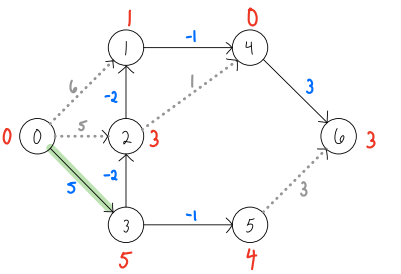


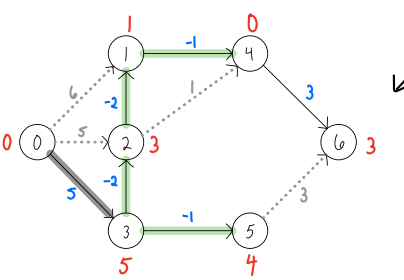


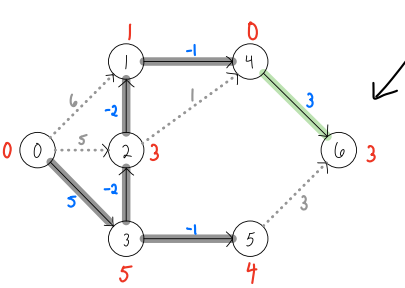












finish

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.

Python, sorry!

code in separate file