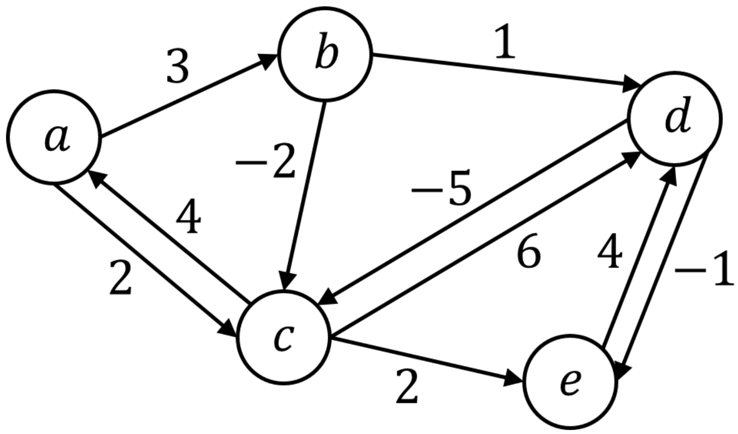
COSC 311: ALGORITHMS
MINI 8

Due Friday, November 8 in class

1. Shortest paths revisited. Here's a graph:



Fill in the below table to show what happens when you run the Bellman-Ford algorithm on this graph to find the shortest path from a to each other node.

Solution:

	0	1	2	3	4
a	0	0	0	0	0
b	∞	3	3	3	3
c	∞	2	1	-1	-1
d	∞	∞	4	4	4
e	∞	∞	4	3	1

2. Reconstructing solutions. Explain how to use the filled-in table from problem 1 to reconstruct the sequence of nodes visited on the shortest path from a to e.

Solution: We begin in row e, column 4, which stores the cost of the shortest path from a to e. This value is 1, which must be equal to either (1) the shortest path from a to e using at most 3 edges (stored in row e, column 3 of the table), or (2) the cost of some edge (x, e) into e, plus the shortest path from a to x. There are two options here: (c, e), which has cost 2, plus the entry in row c and column 3, which is -1; and (d, e), which has cost -1, plus the entry in row d and column 3, which is 4. The (c, e) option matches the value stored in row e, column 4, so we know that edge (c, e) is part of the shortest path to e.

We continue tracing backwards from row c, column 3. We have four options: (1) row c, column 2: cost 1; (2) edge (a, c) plus row a, column 2: cost 2; (3) edge (b, c) plus row b, column 2: cost 1; (4) edge (d, c) plus row d, column 2: cost -1. The (d, c) option matches the value stored in row c, column 3, so we add (d, c) to our solution path.

We continue backwards in this manner and find that edges (b, d) and (a, b) are also part of the shortest path from a to e.