1. Write the content of the queue Q/ the set S/ keys d(v) after 5 iterations of the Dijkstra algorithm for the graph G below and source s (weights are on edges):

Q = V2, V3, V6, V8   S = S, V4, V1, V5, V7   20

d(s) = 0   d(v1)= 5   d(v2)= 17   d(v3)= 14

d(v4)= 3   d(v5)= 8   d(v6)= 13   d(v7)= 10   d(v8)= ∞.

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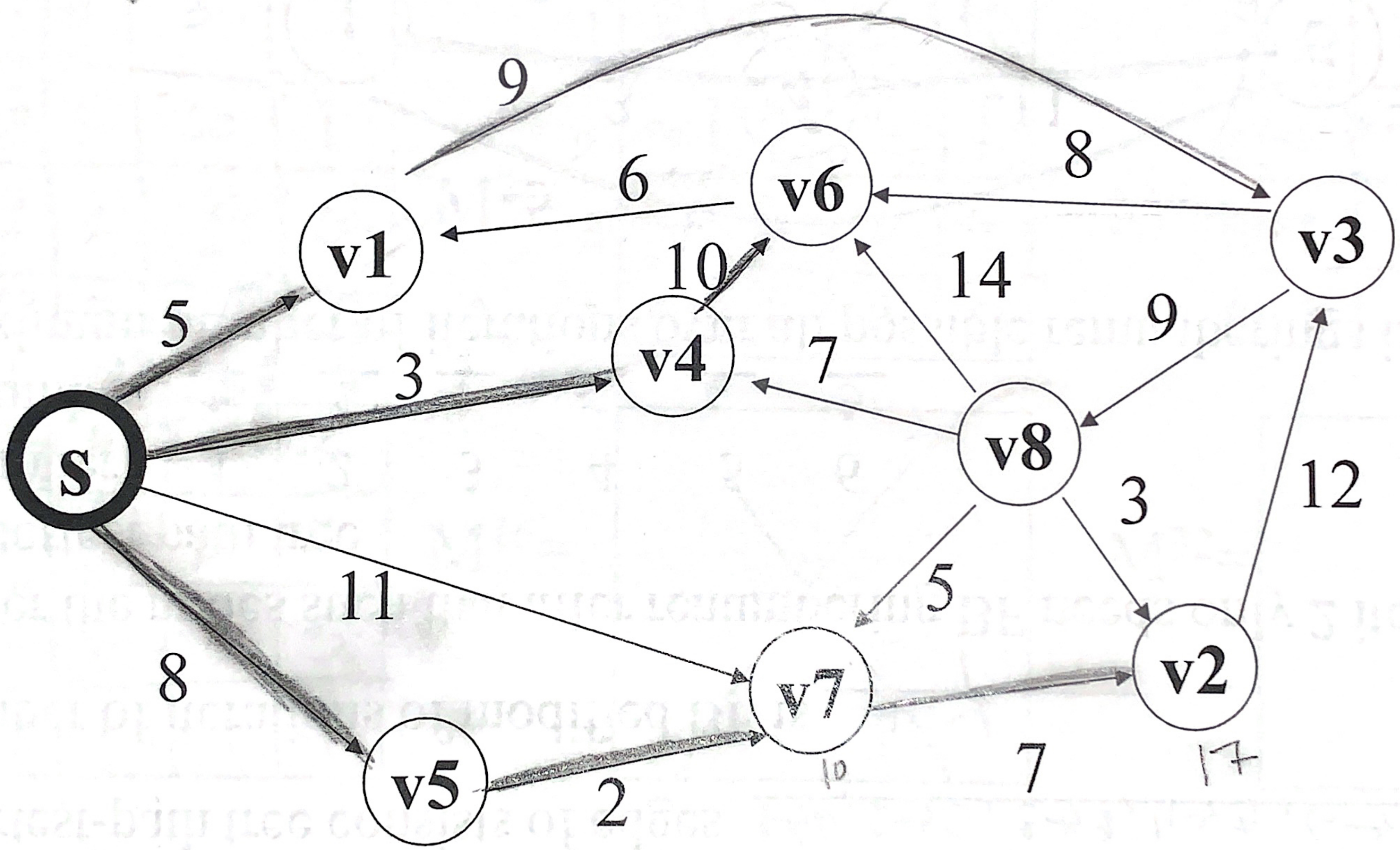


Quiz 3 CS4520   NAME

2. Using Bellman-Ford, find the shortest path tree from the node 3

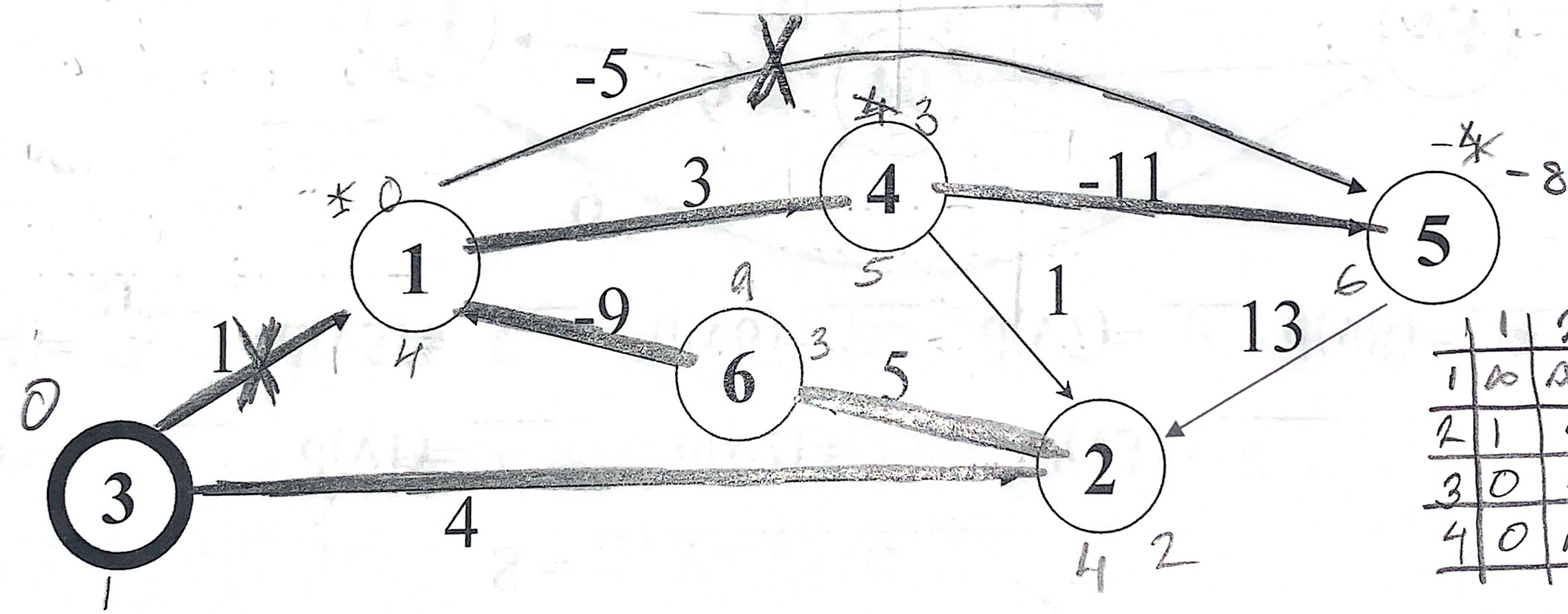
- the shortest-path tree consists of edges 1→4, 2→6, 3→2, 4→5, 6→1 ✓ ✓ ✓ ✓ ✗ 15

- the number of iterations of modified BF is 4

- renumber the nodes such that after renumbering BF needs only 2 iterations to find shortest path tree

old number	1	2	3	4	5	6
new number	4	2	1	5	6	3

- the maximum number of iterations over all possible renumberings is 5 ?



	1	2	3	4	5	6
1	∞	∞	0	∞	∞	∞
2	1	4	0	4	-5	9
3	0	4	0	4	-8	9
4	0	4	0	3	-8	9

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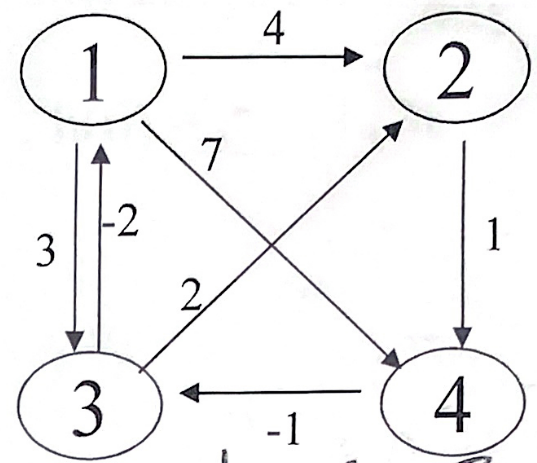
4. Find all shortest path weights with the matrix multiplication method for the graph on the right side.

- give all matrices that are obtained on the way,
- are there any negative cycles in the graph? No



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$$M=\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 4 & 3 & 7 \\ 2 & \infty & 0 & \infty & 1 \\ 3 & -2 & 2 & 0 & \infty \\ 4 & \infty & \infty & -1 & 0 \end{array}$$

$$M^2=\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 4 & 3 & 5 \\ 2 & \infty & 0 & 0 & 1 \\ 3 & -2 & 2 & 0 & 3 \\ 4 & -3 & 1 & -1 & 0 \end{array}$$

$$M^4=\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 4 & 3 & 5 \\ 2 & -2 & 0 & 0 & 1 \\ 3 & -2 & 2 & 0 & 3 \\ 4 & -3 & 1 & -1 & 0 \end{array}$$

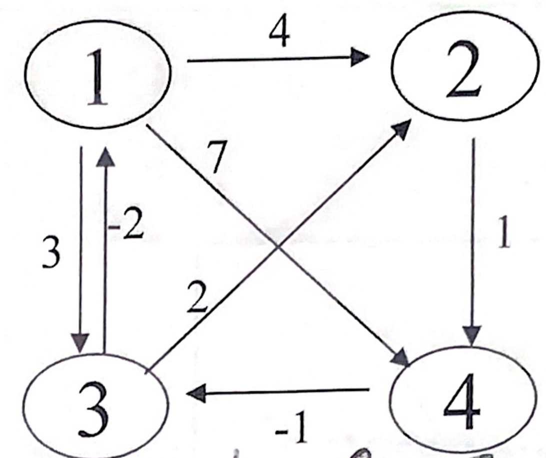
$$M^8=\begin{array}{c|cccc} & 1 & 2 & 3 & 4 \\ \hline 1 & 0 & 4 & 3 & 5 \\ 2 & -2 & 0 & 0 & 1 \\ 3 & -2 & 2 & 0 & 3 \\ 4 & -3 & 1 & -1 & 0 \end{array}$$

$M^{16}=$

$M^{32}=$

5. Find all shortest path weights with the Floyd-Warshall method for the graph on the right side.

- give all matrices that are obtained on the way



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$C^0 =$

	1	2	3	4
1	0	4	3	7
2	∞	0	∞	1
3	-2	2	0	∞
4	∞	∞	-1	0

$C^1 =$

	1	2	3	4
1	0	4	3	7
2	∞	0	∞	1
3	-2	2	0	5
4	∞	∞	-1	0

$C^2 =$

	1	2	3	4
1	0	4	3	5
2	∞	0	∞	1
3	-2	2	0	3
4	∞	∞	-1	0

$C^3 =$

	1	2	3	4
1	0	4	3	5
2	∞	0	∞	1
3	-2	2	0	3
4	-3	1	-1	0

$C^4 =$

	1	2	3	4
1	0	4	3	5
2	-2	0	0	1
3	-2	2	0	3
4	-3	1	-1	0

Quiz 3 CS4520 NAME ____________

6. Johnson's algorithm is applied to the graph below.

(a) Give h(1) = 0, h(2)= -2 h(3)= -9, h(4)= -1, h(5)= -9, h(6) = 0, h(7)= -3

Give the **modified** weight of

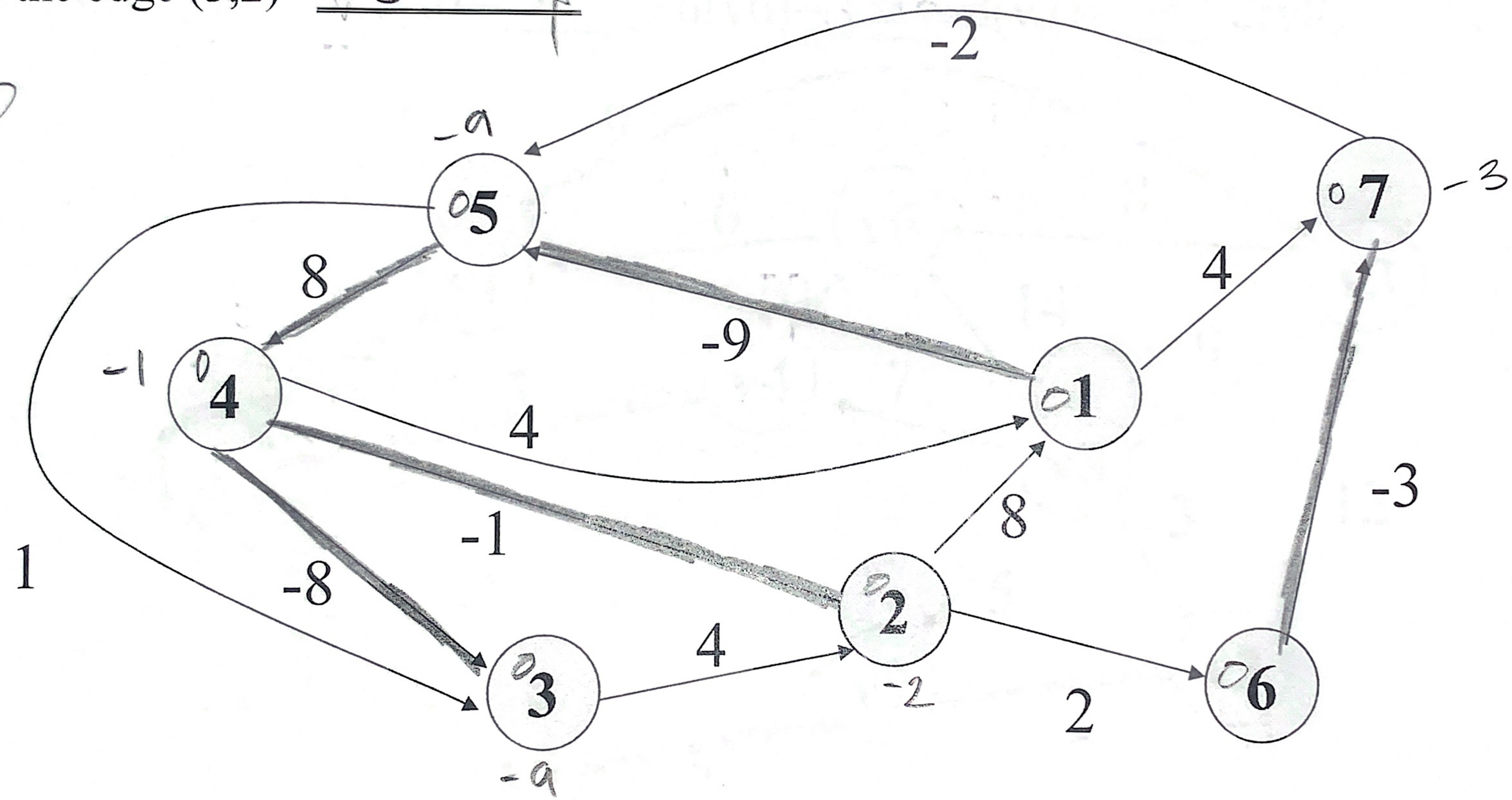
(b) the shortest 2-to-3-path -1

2→1→5→4→3

8 + -9 + 8 + -8 = -1

(c) the edge (3,2) -3

16.



W+beg-end

4+-9--2=-3

Quiz 3 CS4520 NAME