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1001696560

Lab 2 Write Up

How to compile and run:

- Unzip the 1001696560 folder
- Open the terminal and change directories into the 1001696560 folder
- Run the command ‘python3 dv.py input.txt’ in the command line to run the distance vector algorithm
- (input.txt is already in the 1001696560 folder)

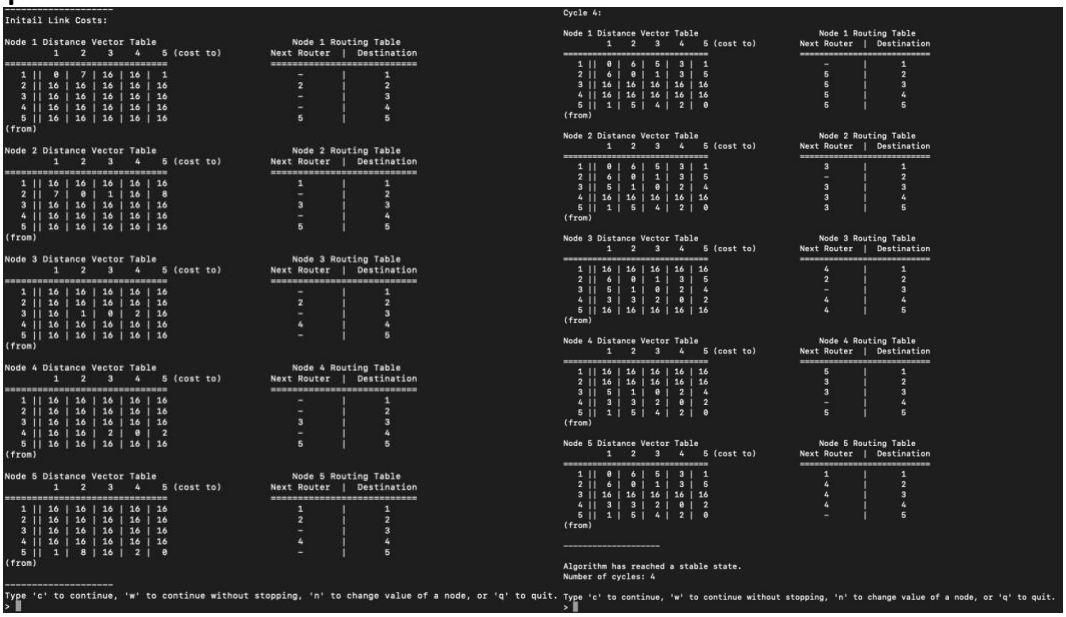
Any known bugs or limitations:

- Infinity is set to 16

Any assumptions your program made:

- Python3 is downloaded and installed on your machine
- The input file is in the same directory as the dv.py file and the input file is also in the correct format
- The provided input.txt file contains the example given in the assignment, but can be replaced with any input file in the correct format
- A user cannot edit the cost of a link to itself
- A user cannot set a link cost to be greater than 16 or less than 0

GUI Requirements:



- [initial state] [stable state]
- My GUI implementation shows the **distance vector table** and **routing table** for every node after initially reading the input file and it is updated after every cycle of the distance vector algorithm.
- The distance vector table row represents the from node and the column represents the to node. For example, the value in row 1 and column 2 is 7. This is the least cost path from node 1 to node 2 at the initial state of the algorithm. The routing table shows the next node to go to if you want to reach a specific node. For example, to get from 1 to 2 in the stable state above, going through 5 is the shortest path.
- You can **run the simulation in a controlled** way (single step mode) by entering ‘c’ into the user prompt after every cycle. The **distance vectors for each step** for the input provided in the assignment are included in the section below.
- As shown at the end of the assignment, **the algorithm detects a stable state** when there are no more changes to any of the links for any of the nodes after a cycle. When it reaches a stable state, a comment is displayed at the bottom of the window including the number of cycles. In this case, it took 4 cycles to reach a stable state.
- To **run the algorithm without stopping**, you can enter ‘w’ into the user prompt after the initial link costs are loaded. This will run the algorithm until it reaches a stable state and **display the total time** and number of cycles. My algorithm took 0.004763 seconds and 4 cycles. I included screen shots below as well.

Passing DV’s among nodes:

- Nodes were stored as a 3d list. They were only allowed to send data to other nodes that they were directly connected to. This ensured that they acted the same way that they would in a network.

Input files:

- You can change the input file to whatever you like as long as it has costs that range from 0 to 16 and nodes are number from 1 to n.

Adjusting link costs:

- You can adjust the cost of any link in the network at any time while in single step mode. You can change any link cost by entering ‘n’ into the user prompt. You can select the two nodes you would like to change the link cost between and enter the new link cost. Once the cost is changed, it will be displayed back to you and it will run the algorithm in either single step mode or without stopping.
- A line failure and line repair are shown in screenshots below. From the line failure between node 1 and node 5, it took 7 cycles and 0.010078 seconds to reach a stable state. The line repair between node 1 and node 5 took 0.007923 seconds and 4 cycles to reach a stable state.

Distance Vector algorithm running in single step mode:

```
Initail Link Costs:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 ||  0 |  7 | 16 | 16 |  1                      -       |       1
   2 || 16 | 16 | 16 | 16 | 16                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      -       |       3
   4 || 16 | 16 | 16 | 16 | 16                      -       |       4
   5 || 16 | 16 | 16 | 16 | 16                      5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      1       |       1
   2 ||  7 |  0 |  1 | 16 |  8                      -       |       2
   3 || 16 | 16 | 16 | 16 | 16                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      -       |       4
   5 || 16 | 16 | 16 | 16 | 16                      5       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      -       |       1
   2 || 16 | 16 | 16 | 16 | 16                      2       |       2
   3 || 16 |  1 |  0 |  2 | 16                      -       |       3
   4 || 16 | 16 | 16 | 16 | 16                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      -       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      -       |       1
   2 || 16 | 16 | 16 | 16 | 16                      -       |       2
   3 || 16 | 16 | 16 | 16 | 16                      3       |       3
   4 || 16 | 16 |  2 |  0 |  2                      -       |       4
   5 || 16 | 16 | 16 | 16 | 16                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      1       |       1
   2 || 16 | 16 | 16 | 16 | 16                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      -       |       3
   4 || 16 | 16 | 16 | 16 | 16                      4       |       4
   5 ||  1 |  8 | 16 |  2 |  0                      -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
--------------------
Cycle 1:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 ||  0 |  7 | 16 | 16 |  1                      -       |       1
   2 ||  7 |  0 |  1 | 16 |  8                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      -       |       3
   4 || 16 | 16 | 16 | 16 | 16                      -       |       4
   5 ||  1 |  8 | 16 |  2 |  0                      5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 ||  0 |  7 | 16 | 16 |  1                      1       |       1
   2 ||  7 |  0 |  1 | 16 |  8                      -       |       2
   3 || 16 |  1 |  0 |  2 | 16                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      -       |       4
   5 ||  1 |  8 | 16 |  2 |  0                      5       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      -       |       1
   2 ||  7 |  0 |  1 | 16 |  8                      2       |       2
   3 || 16 |  1 |  0 |  2 | 16                      -       |       3
   4 || 16 | 16 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      -       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 || 16 | 16 | 16 | 16 | 16                      -       |       1
   2 || 16 | 16 | 16 | 16 | 16                      -       |       2
   3 || 16 |  1 |  0 |  2 | 16                      3       |       3
   4 || 16 | 16 |  2 |  0 |  2                      -       |       4
   5 ||  1 |  8 | 16 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ============================
   1 ||  0 |  7 | 16 | 16 |  1                      1       |       1
   2 ||  7 |  0 |  1 | 16 |  8                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      -       |       3
   4 || 16 | 16 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  8 | 16 |  2 |  0                      -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

```
Cycle 2:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  8 |  3 |  1                       -       |       1
   2 ||  7 |  0 |  1 |  3 |  8                       2       |       2
   3 || 16 | 16 | 16 | 16 | 16                       2       |       3
   4 || 16 | 16 | 16 | 16 | 16                       5       |       4
   5 ||  1 |  8 |  4 |  2 |  0                       5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  8 |  3 |  1                       1       |       1
   2 ||  7 |  0 |  1 |  3 |  8                       -       |       2
   3 ||  8 |  1 |  0 |  2 |  4                       3       |       3
   4 || 16 | 16 | 16 | 16 | 16                       3       |       4
   5 ||  1 |  8 |  4 |  2 |  0                       5       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       2       |       1
   2 ||  7 |  0 |  1 |  3 |  8                       2       |       2
   3 ||  8 |  1 |  0 |  2 |  4                       -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 | 16 | 16 | 16 | 16                       4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       5       |       1
   2 || 16 | 16 | 16 | 16 | 16                       3       |       2
   3 ||  8 |  1 |  0 |  2 |  4                       3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       -       |       4
   5 ||  1 |  8 |  4 |  2 |  0                       5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  8 |  3 |  1                       1       |       1
   2 ||  7 |  0 |  1 |  3 |  8                       2       |       2
   3 || 16 | 16 | 16 | 16 | 16                       4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 ||  1 |  8 |  4 |  2 |  0                       -       |       5
(from)

---------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 3:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  5 |  3 |  1                       -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                       2       |       2
   3 || 16 | 16 | 16 | 16 | 16                       5       |       3
   4 || 16 | 16 | 16 | 16 | 16                       5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  5 |  3 |  1                       1       |       1
   2 ||  7 |  0 |  1 |  3 |  5                       -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 || 16 | 16 | 16 | 16 | 16                       3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                       2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 | 16 | 16 | 16 | 16                       4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       5       |       1
   2 || 16 | 16 | 16 | 16 | 16                       3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  7 |  5 |  3 |  1                       1       |       1
   2 ||  7 |  0 |  1 |  3 |  5                       4       |       2
   3 || 16 | 16 | 16 | 16 | 16                       4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       -       |       5
(from)

---------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

```
Cycle 4:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
============================================    ============================
   1 ||  0 |  6 |  5 |  3 |  1                       -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       5       |       2
   3 || 16 | 16 | 16 | 16 | 16                       5       |       3
   4 || 16 | 16 | 16 | 16 | 16                       5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
============================================    ============================
   1 ||  0 |  6 |  5 |  3 |  1                       3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 || 16 | 16 | 16 | 16 | 16                       3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
============================================    ============================
   1 || 16 | 16 | 16 | 16 | 16                       4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 | 16 | 16 | 16 | 16                       4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
============================================    ============================
   1 || 16 | 16 | 16 | 16 | 16                       5       |       1
   2 || 16 | 16 | 16 | 16 | 16                       3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)       Next Router  |  Destination
============================================    ============================
   1 ||  0 |  6 |  5 |  3 |  1                       1       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       4       |       2
   3 || 16 | 16 | 16 | 16 | 16                       4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       -       |       5
(from)

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Algorithm has reached a stable state.
Number of cycles: 4

Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
>
```
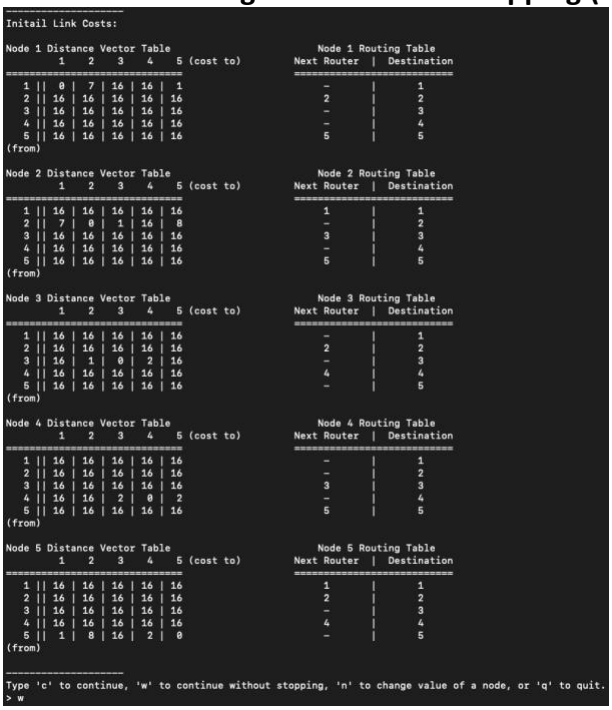

Distance vector algorithm without stopping (excluding intermediate steps):



```
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Initail Link Costs:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 ||  0 |  7 | 16 | 16 |  1                      -       |       1
   2 || 16 | 16 | 16 | 16 | 16                     2       |       2
   3 || 16 | 16 | 16 | 16 | 16                     -       |       3
   4 || 16 | 16 | 16 | 16 | 16                     -       |       4
   5 || 16 | 16 | 16 | 16 | 16                     5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     1       |       1
   2 ||  7 |  0 |  1 | 16 |  8                     -       |       2
   3 || 16 | 16 | 16 | 16 | 16                     3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     -       |       4
   5 || 16 | 16 | 16 | 16 | 16                     5       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     -       |       1
   2 || 16 | 16 | 16 | 16 | 16                     2       |       2
   3 || 16 |  1 |  0 |  2 | 16                     -       |       3
   4 || 16 | 16 | 16 | 16 | 16                     4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     -       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     -       |       1
   2 || 16 | 16 | 16 | 16 | 16                     -       |       2
   3 || 16 | 16 | 16 | 16 | 16                     3       |       3
   4 || 16 | 16 |  2 |  0 |  2                     -       |       4
   5 || 16 | 16 | 16 | 16 | 16                     5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     1       |       1
   2 || 16 | 16 | 16 | 16 | 16                     2       |       2
   3 || 16 | 16 | 16 | 16 | 16                     -       |       3
   4 || 16 | 16 | 16 | 16 | 16                     4       |       4
   5 ||  1 |  8 | 16 |  2 |  0                     -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> w
```
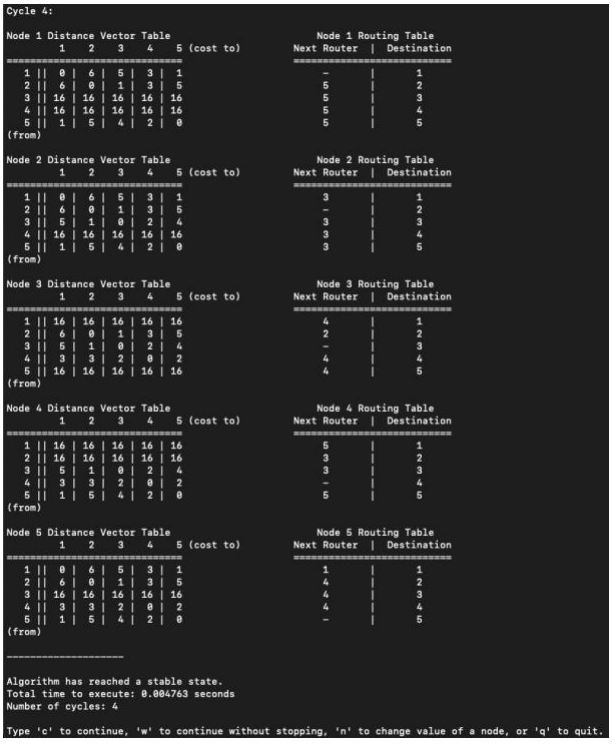

[. . .]



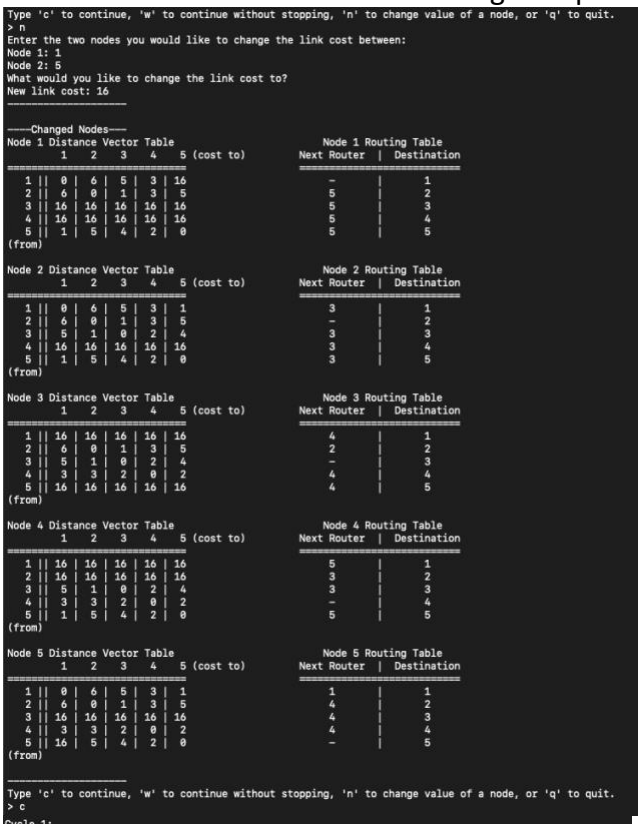
```
Cycle 4:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 ||  0 |  6 |  5 |  3 |  1                      -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                      5       |       2
   3 || 16 | 16 | 16 | 16 | 16                     5       |       3
   4 || 16 | 16 | 16 | 16 | 16                     5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                     5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 ||  0 |  6 |  5 |  3 |  1                      3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                     3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 || 16 | 16 | 16 | 16 | 16                     5       |       1
   2 || 16 | 16 | 16 | 16 | 16                     3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                     5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
============================                    ============================
   1 ||  0 |  6 |  5 |  3 |  1                      1       |       1
   2 ||  6 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                     4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                     -       |       5
(from)

--------------------

Algorithm has reached a stable state.
Total time to execute: 0.004763 seconds
Number of cycles: 4

Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
```

Total time: 0.004763 seconds

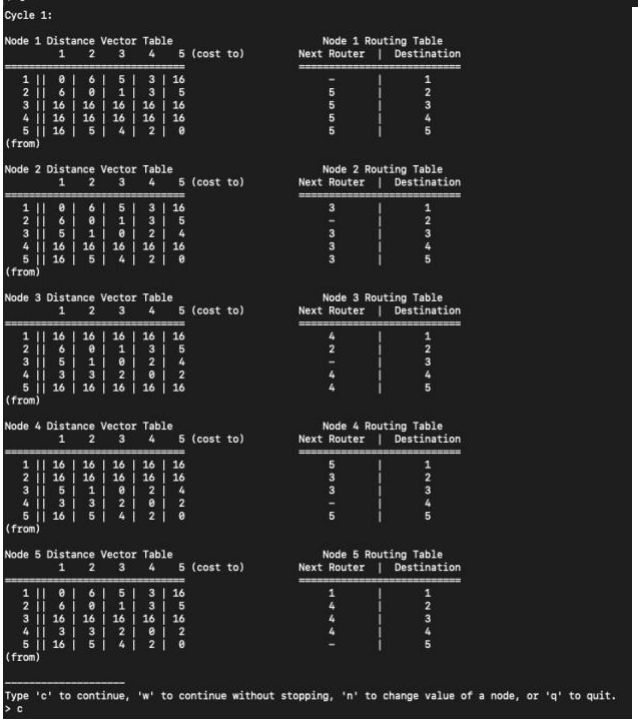
Number of cycles: 4

Simulate a line failure (single step mode then without stopping):

- I am starting from a stable state shown previously and setting the link cost between node 1 and node 5 to 16.
- The screenshots below are single step mode.



```
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> n
Enter the two nodes you would like to change the link cost between:
Node 1: 1
Node 2: 5
What would you like to change the link cost to?
New link cost: 16
--------------------

----Changed Nodes----
Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 | 16                       -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       5       |       2
   3 || 16 | 16 | 16 | 16 | 16                       5       |       3
   4 || 16 | 16 | 16 | 16 | 16                       5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 |  1                       3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 || 16 | 16 | 16 | 16 | 16                       3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 | 16 | 16 | 16 | 16                       4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       5       |       1
   2 || 16 | 16 | 16 | 16 | 16                       3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 |  1                       1       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       4       |       2
   3 || 16 | 16 | 16 | 16 | 16                       4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 |  5 |  4 |  2 |  0                       -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```



```
Cycle 1:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 | 16                       -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       5       |       2
   3 || 16 | 16 | 16 | 16 | 16                       5       |       3
   4 || 16 | 16 | 16 | 16 | 16                       5       |       4
   5 || 16 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 | 16                       3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 || 16 | 16 | 16 | 16 | 16                       3       |       4
   5 || 16 |  5 |  4 |  2 |  0                       3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 | 16 | 16 | 16 | 16                       4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 || 16 | 16 | 16 | 16 | 16                       5       |       1
   2 || 16 | 16 | 16 | 16 | 16                       3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                       3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       -       |       4
   5 || 16 |  5 |  4 |  2 |  0                       5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================                   ============================
   1 ||  0 |  6 |  5 |  3 | 16                       1       |       1
   2 ||  6 |  0 |  1 |  3 |  5                       4       |       2
   3 || 16 | 16 | 16 | 16 | 16                       4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                       4       |       4
   5 || 16 |  5 |  4 |  2 |  0                       -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

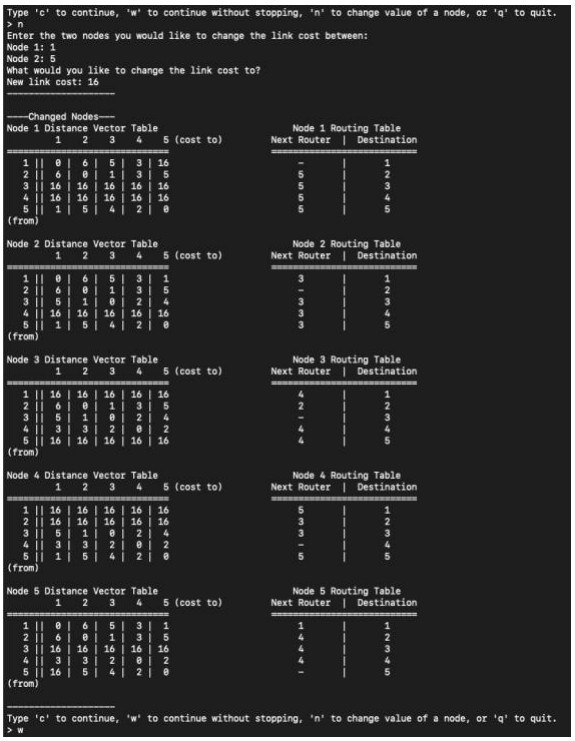
```
Cycle 2:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     2       |       2
   3 || 16 | 16 | 16 | 16 | 16                     2       |       3
   4 || 16 | 16 | 16 | 16 | 16                     2       |       4
   5 ||  5 |  5 |  4 |  2 |  0                     2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                     3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     3       |       4
   5 ||  5 |  5 |  4 |  2 |  0                     3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 || 16 | 16 | 16 | 16 | 16                     4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                     -       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 || 16 | 16 | 16 | 16 | 16                     3       |       1
   2 || 16 | 16 | 16 | 16 | 16                     3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                     3       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     -       |       4
   5 ||  5 |  5 |  4 |  2 |  0                     5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     4       |       2
   3 || 16 | 16 | 16 | 16 | 16                     4       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     4       |       4
   5 ||  5 |  5 |  4 |  2 |  0                     -       |       5
(from)

_________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 3:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     -       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     2       |       2
   3 || 16 | 16 | 16 | 16 | 16                     2       |       3
   4 || 16 | 16 | 16 | 16 | 16                     2       |       4
   5 ||  9 |  5 |  4 |  2 |  0                     2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     3       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     -       |       2
   3 ||  7 |  1 |  0 |  2 |  4                     3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     3       |       4
   5 ||  9 |  5 |  4 |  2 |  0                     3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 || 16 | 16 | 16 | 16 | 16                     2       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     2       |       2
   3 ||  7 |  1 |  0 |  2 |  4                     -       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 || 16 | 16 | 16 | 16 | 16                     3       |       1
   2 || 16 | 16 | 16 | 16 | 16                     3       |       2
   3 ||  7 |  1 |  0 |  2 |  4                     3       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     -       |       4
   5 ||  9 |  5 |  4 |  2 |  0                     5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=============================                 ==========================
   1 ||  0 |  7 |  8 | 10 | 12                     4       |       1
   2 ||  6 |  0 |  1 |  3 |  5                     4       |       2
   3 || 16 | 16 | 16 | 16 | 16                     4       |       3
   4 ||  7 |  3 |  2 |  0 |  2                     4       |       4
   5 ||  9 |  5 |  4 |  2 |  0                     -       |       5
(from)

_________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

```
Cycle 4:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      2       |       3
   4 || 16 | 16 | 16 | 16 | 16                      2       |       4
   5 ||  9 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  7 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      3       |       4
   5 ||  9 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 || 16 | 16 | 16 | 16 | 16                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  7 |  1 |  0 |  2 |  4                      -       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 || 16 | 16 | 16 | 16 | 16                      3       |       1
   2 || 16 | 16 | 16 | 16 | 16                      3       |       2
   3 ||  7 |  1 |  0 |  2 |  4                      3       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      -       |       4
   5 ||  9 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                      4       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  9 |  5 |  4 |  2 |  0                      -       |       5
(from)

____________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 5:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      2       |       3
   4 || 16 | 16 | 16 | 16 | 16                      2       |       4
   5 || 11 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      3       |       4
   5 || 11 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 || 16 | 16 | 16 | 16 | 16                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      -       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 || 16 | 16 | 16 | 16 | 16                      3       |       1
   2 || 16 | 16 | 16 | 16 | 16                      3       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      -       |       4
   5 || 11 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)       Next Router  |  Destination
=========================================     ==========================
   1 ||  0 |  7 |  8 | 10 | 12                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                      4       |       3
   4 ||  9 |  3 |  2 |  0 |  2                      4       |       4
   5 || 11 |  5 |  4 |  2 |  0                      -       |       5
(from)

____________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

```
Cycle 6:

Node 1 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 16 | 16 | 16 | 16 | 16
   5 || 11 |  5 |  4 |  2 |  0
(from)

Node 1 Routing Table
Next Router  |  Destination
=========================
     -       |      1
     2       |      2
     2       |      3
     2       |      4
     2       |      5

Node 2 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 16 | 16 | 16 | 16 | 16
   5 || 11 |  5 |  4 |  2 |  0
(from)

Node 2 Routing Table
Next Router  |  Destination
=========================
     2       |      1
     -       |      2
     3       |      3
     3       |      4
     3       |      5

Node 3 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 || 16 | 16 | 16 | 16 | 16
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 16 | 16 | 16 | 16 | 16
(from)

Node 3 Routing Table
Next Router  |  Destination
=========================
     2       |      1
     2       |      2
     -       |      3
     4       |      4
     4       |      5

Node 4 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 || 16 | 16 | 16 | 16 | 16
   2 || 16 | 16 | 16 | 16 | 16
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 11 |  5 |  4 |  2 |  0
(from)

Node 4 Routing Table
Next Router  |  Destination
=========================
     3       |      1
     3       |      2
     3       |      3
     -       |      4
     5       |      5

Node 5 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 10 |  3 |  2 |  0 |  2
   5 || 11 |  5 |  4 |  2 |  0
(from)

Node 5 Routing Table
Next Router  |  Destination
=========================
     4       |      1
     4       |      2
     4       |      3
     4       |      4
     -       |      5

_____________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 7:

Node 1 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 16 | 16 | 16 | 16 | 16
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 1 Routing Table
Next Router  |  Destination
=========================
     -       |      1
     2       |      2
     2       |      3
     2       |      4
     2       |      5

Node 2 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 16 | 16 | 16 | 16 | 16
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 2 Routing Table
Next Router  |  Destination
=========================
     2       |      1
     -       |      2
     3       |      3
     3       |      4
     3       |      5

Node 3 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 || 16 | 16 | 16 | 16 | 16
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 16 | 16 | 16 | 16 | 16
(from)

Node 3 Routing Table
Next Router  |  Destination
=========================
     2       |      1
     2       |      2
     -       |      3
     4       |      4
     4       |      5

Node 4 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 || 16 | 16 | 16 | 16 | 16
   2 || 16 | 16 | 16 | 16 | 16
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 4 Routing Table
Next Router  |  Destination
=========================
     3       |      1
     3       |      2
     3       |      3
     -       |      4
     5       |      5

Node 5 Distance Vector Table
        1    2    3    4    5 (cost to)
=========================================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 10 |  3 |  2 |  0 |  2
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 5 Routing Table
Next Router  |  Destination
=========================
     4       |      1
     4       |      2
     4       |      3
     4       |      4
     -       |      5

_____________________

Algorithm has reached a stable state.
Number of cycles: 7

Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

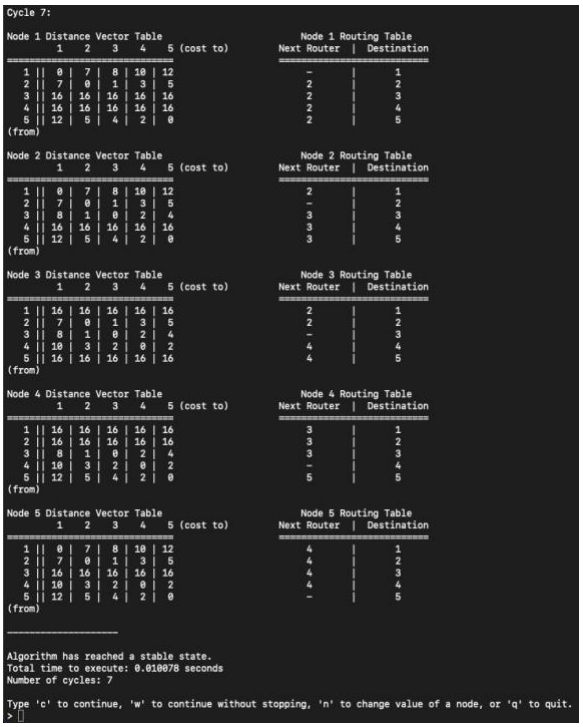
- The algorithm reaches a stable state after 7 cycles.

- The screen shots below are the line failure without stopping (excluding the intermediate steps)



```
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> n
Enter the two nodes you would like to change the link cost between:
Node 1: 1
Node 2: 5
What would you like to change the link cost to?
New link cost: 16
--------------------

-----Changed Nodes-----
Node 1 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  6 |  5 |  3 | 16
   2 ||  6 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 16 | 16 | 16 | 16 | 16
   5 ||  1 |  5 |  4 |  2 |  0
(from)

Node 2 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  6 |  5 |  3 |  1
   2 ||  6 |  0 |  1 |  3 |  5
   3 ||  5 |  1 |  0 |  2 |  4
   4 || 16 | 16 | 16 | 16 | 16
   5 ||  1 |  5 |  4 |  2 |  0
(from)

Node 3 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 || 16 | 16 | 16 | 16 | 16
   2 ||  6 |  0 |  1 |  3 |  5
   3 ||  5 |  1 |  0 |  2 |  4
   4 ||  3 |  3 |  2 |  0 |  2
   5 || 16 | 16 | 16 | 16 | 16
(from)

Node 4 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 || 16 | 16 | 16 | 16 | 16
   2 || 16 | 16 | 16 | 16 | 16
   3 ||  5 |  1 |  0 |  2 |  4
   4 ||  3 |  3 |  2 |  0 |  2
   5 ||  1 |  5 |  4 |  2 |  0
(from)

Node 5 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  6 |  5 |  3 |  1
   2 ||  6 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 ||  3 |  3 |  2 |  0 |  2
   5 || 16 |  5 |  4 |  2 |  0
(from)

Node 1 Routing Table
Next Router  |  Destination
==========================
      -      |       1
      5      |       2
      5      |       3
      5      |       4
      5      |       5

Node 2 Routing Table
Next Router  |  Destination
==========================
      3      |       1
      -      |       2
      3      |       3
      3      |       4
      3      |       5

Node 3 Routing Table
Next Router  |  Destination
==========================
      4      |       1
      2      |       2
      -      |       3
      4      |       4
      4      |       5

Node 4 Routing Table
Next Router  |  Destination
==========================
      5      |       1
      3      |       2
      3      |       3
      -      |       4
      5      |       5

Node 5 Routing Table
Next Router  |  Destination
==========================
      1      |       1
      4      |       2
      4      |       3
      4      |       4
      -      |       5

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> w
```

[. . .]

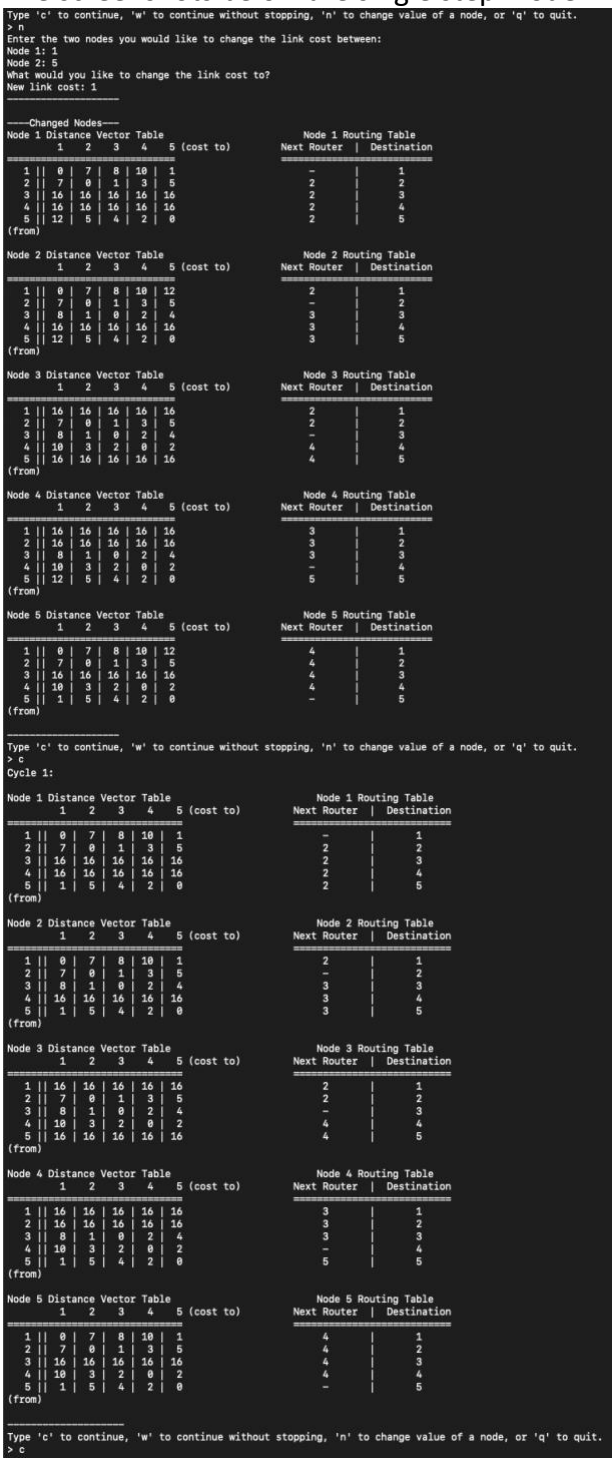


```
Cycle 7:

Node 1 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 16 | 16 | 16 | 16 | 16
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 2 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 16 | 16 | 16 | 16 | 16
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 3 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 || 16 | 16 | 16 | 16 | 16
   2 ||  7 |  0 |  1 |  3 |  5
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 16 | 16 | 16 | 16 | 16
(from)

Node 4 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 || 16 | 16 | 16 | 16 | 16
   2 || 16 | 16 | 16 | 16 | 16
   3 ||  8 |  1 |  0 |  2 |  4
   4 || 10 |  3 |  2 |  0 |  2
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 5 Distance Vector Table
        1   2   3   4   5 (cost to)
==============================
   1 ||  0 |  7 |  8 | 10 | 12
   2 ||  7 |  0 |  1 |  3 |  5
   3 || 16 | 16 | 16 | 16 | 16
   4 || 10 |  3 |  2 |  0 |  2
   5 || 12 |  5 |  4 |  2 |  0
(from)

Node 1 Routing Table
Next Router  |  Destination
==========================
      -      |       1
      2      |       2
      2      |       3
      2      |       4
      2      |       5

Node 2 Routing Table
Next Router  |  Destination
==========================
      2      |       1
      -      |       2
      3      |       3
      3      |       4
      3      |       5

Node 3 Routing Table
Next Router  |  Destination
==========================
      2      |       1
      2      |       2
      -      |       3
      4      |       4
      4      |       5

Node 4 Routing Table
Next Router  |  Destination
==========================
      3      |       1
      3      |       2
      3      |       3
      -      |       4
      5      |       5

Node 5 Routing Table
Next Router  |  Destination
==========================
      4      |       1
      4      |       2
      4      |       3
      4      |       4
      -      |       5

--------------------

Algorithm has reached a stable state.
Total time to execute: 0.010078 seconds
Number of cycles: 7

Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
>
```

- The line failure took 0.010078 seconds and 7 cycles of the algorithm.

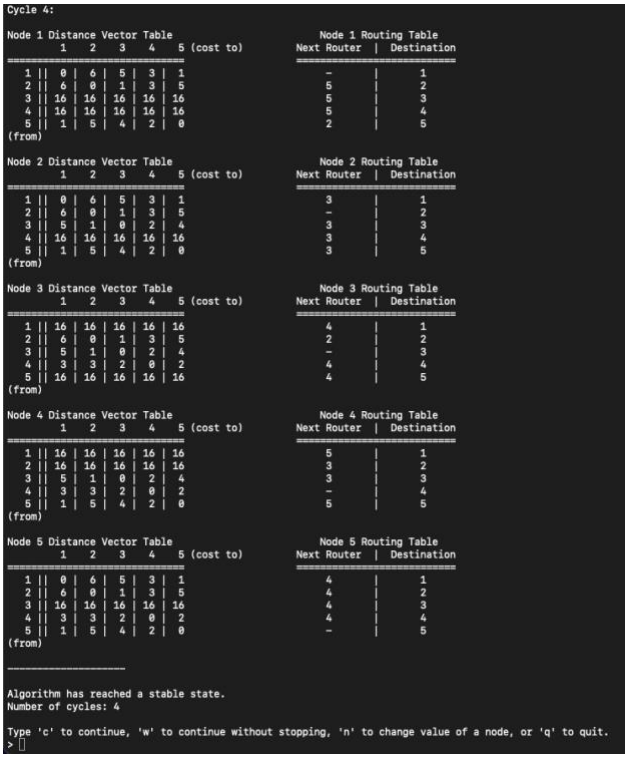
Simulate a line repair (single step mode then without stopping):

- I am starting from a stable state after the line failure above and setting the link between node 1 and node 5 back to 1.
- The screenshots below are single step mode.



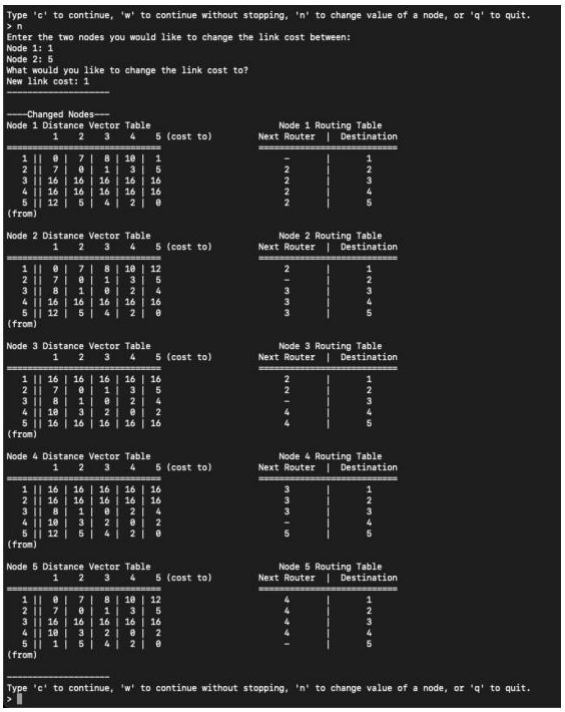
```
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> n
Enter the two nodes you would like to change the link cost between:
Node 1: 1
Node 2: 5
What would you like to change the link cost to?
New link cost: 1
--------------------

---Changed Nodes---
Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 |  1                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      2       |       3
   4 || 16 | 16 | 16 | 16 | 16                      2       |       4
   5 || 12 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 | 12                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      3       |       4
   5 || 12 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 || 16 | 16 | 16 | 16 | 16                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      -       |       3
   4 || 10 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 || 16 | 16 | 16 | 16 | 16                      3       |       1
   2 || 16 | 16 | 16 | 16 | 16                      3       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 10 |  3 |  2 |  0 |  2                      -       |       4
   5 || 12 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 | 12                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                      4       |       3
   4 || 10 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 1:

Node 1 Distance Vector Table                    Node 1 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 |  1                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 || 16 | 16 | 16 | 16 | 16                      2       |       3
   4 || 16 | 16 | 16 | 16 | 16                      2       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 |  1                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                      3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 || 16 | 16 | 16 | 16 | 16                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      -       |       3
   4 || 10 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                      4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 || 16 | 16 | 16 | 16 | 16                      3       |       1
   2 || 16 | 16 | 16 | 16 | 16                      3       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 10 |  3 |  2 |  0 |  2                      -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
         1    2    3    4    5 (cost to)      Next Router  |  Destination
=============================                 ========================
   1 ||  0 |  7 |  8 | 10 |  1                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                      4       |       3
   4 || 10 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      -       |       5
(from)

--------------------
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

```
Cycle 2:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      5       |       2
   3 || 16 | 16 | 16 | 16 | 16                     5       |       3
   4 || 16 | 16 | 16 | 16 | 16                     5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 || 16 | 16 | 16 | 16 | 16                     2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 || 16 | 16 | 16 | 16 | 16                     5       |       1
   2 || 16 | 16 | 16 | 16 | 16                     3       |       2
   3 ||  8 |  1 |  0 |  2 |  4                      3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                     4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      -       |       5
(from)

____________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
Cycle 3:

Node 1 Distance Vector Table                    Node 1 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      -       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      5       |       2
   3 || 16 | 16 | 16 | 16 | 16                     5       |       3
   4 || 16 | 16 | 16 | 16 | 16                     5       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      2       |       5
(from)

Node 2 Distance Vector Table                    Node 2 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      2       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      -       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      3       |       3
   4 || 16 | 16 | 16 | 16 | 16                     3       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      3       |       5
(from)

Node 3 Distance Vector Table                    Node 3 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 || 16 | 16 | 16 | 16 | 16                     4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      2       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      -       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 || 16 | 16 | 16 | 16 | 16                     4       |       5
(from)

Node 4 Distance Vector Table                    Node 4 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 || 16 | 16 | 16 | 16 | 16                     5       |       1
   2 || 16 | 16 | 16 | 16 | 16                     3       |       2
   3 ||  5 |  1 |  0 |  2 |  4                      3       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      -       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      5       |       5
(from)

Node 5 Distance Vector Table                    Node 5 Routing Table
        1    2    3    4    5 (cost to)        Next Router  |  Destination
=============================================  ============================
   1 ||  0 |  6 |  5 |  3 |  1                      4       |       1
   2 ||  7 |  0 |  1 |  3 |  5                      4       |       2
   3 || 16 | 16 | 16 | 16 | 16                     4       |       3
   4 ||  3 |  3 |  2 |  0 |  2                      4       |       4
   5 ||  1 |  5 |  4 |  2 |  0                      -       |       5
(from)

____________________
Type 'c' to continue, 'w' to continue without stopping, 'n' to change value of a node, or 'q' to quit.
> c
```

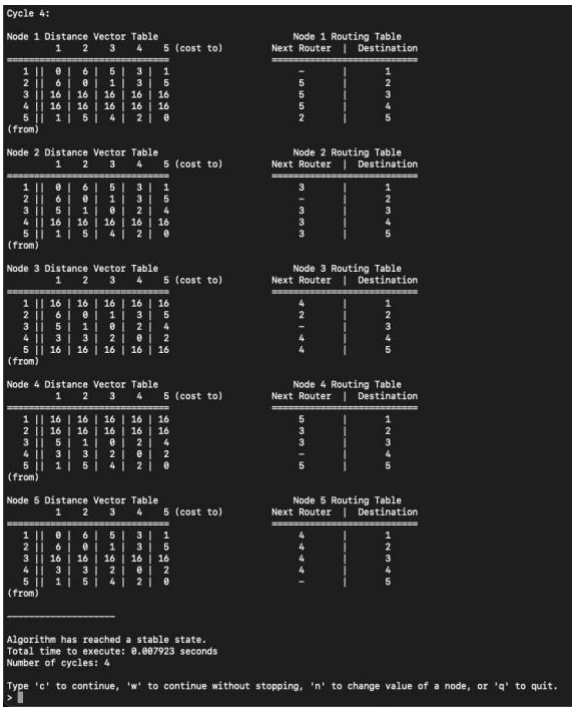


- The algorithm took 4 cycles to reach a stable state

- The screen shots below are the line repair without stopping (excluding the intermediate steps)



[. . .]



- The line repair took 0.007923 seconds and 4 cycles of the algorithm.