Shortest Paths

Back to Week 2

2/3 points earned (66%)

Quiz passed!

1 / 1
points

1.

```
(seed = 481253)
Consider the following edge-weighted digraph with 8 vertices
and 13 edges.

    v->w  weight
    ------------
    B->A    42
    B->C    85
    B->E    16
    B->F    64
    C->D    22
    D->H    23
    E->A    23
    E->F    39
    F->C    24
    F->G    35
    G->C     2
    G->D    14
    G->H    39


Here is a graphical representation of the same edge-weighted digraph:

    (A)<-----42-----(B)------85---->(C)------22---->(D)
     ^              /|             ^^              ^|
     |             / |             / |             / |
     |            /  |            /  |            /  |
     |           /   |           /   |           /   |
     |          /    |          /    |          /    |
     |         /     |         /     |         /     |
     |        /      |        /      |        /      |
     23      16      64      24      2       14      23
     |      /        |      /        |      /        |
     |     /         |     /         |     /         |
     |    /          |    /          |    /          |
     |   /           |   /           |   /           |
     |  /            |  /            |  /            |
     | /             | /             | /             |
     |v              v/              |/              v
    (E)------39---->(F)------35---->(G)------39---->(H)

Here is the distTo[] array before B is relaxed:

           v     A   B   C   D   E   F   G   H
    ----------------------------------------
    distTo[v]    -   0   -   -   -   -   -   -
```

Suppose that you run Dijkstra's algorithm to compute the shortest paths from B to every other vertex. Give the sequence of 8 integers in the distTo[] array immediately after vertex G is relaxed.

39 0 79 101 16 55 90 129

Correct Response

```
The correct answer is: 39 0 79 101 16 55 90 129


Here is the initial distTo[] array:

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]    -   0   -   -   -   -   -   -


Here is the distTo[] array after vertex B is relaxed:
[  edge relaxations that change the distTo[] array:  B->F  B->E  B->C
     B->A  ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   42   0  85   -  16  64   -   -


Here is the distTo[] array after vertex E is relaxed:
[  edge relaxations that change the distTo[] array:  E->F  E->A  ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   39   0  85   -  16  55   -   -


Here is the distTo[] array after vertex A is relaxed:
[  no changes in the distTo[] array ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   39   0  85   -  16  55   -   -


Here is the distTo[] array after vertex F is relaxed:
[  edge relaxations that change the distTo[] array:  F->G  F->C  ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   39   0  79   -  16  55  90   -


Here is the distTo[] array after vertex C is relaxed:
[  edge relaxations that change the distTo[] array:  C->D  ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   39   0  79 101  16  55  90   -


Here is the distTo[] array after vertex G is relaxed:
[  edge relaxations that change the distTo[] array:  G->H  ]

            v     A   B   C   D   E   F   G   H
     ----------------------------------------
     distTo[v]   39   0  79 101  16  55  90 129
```

1 / 1
points

2.

```
(seed = 511394)
Consider the following edge-weighted DAG with 8 vertices and 13
edges.

    v->w  weight
    ------------
    B->A    14
    B->E     2
    C->B    15
    C->D    55
    C->G    38
    E->A    29
    F->B    40
    F->C    19
    F->E     9
    F->G    65
    G->D    12
    G->H    32
    H->D     2


Here is a graphical representation of the same edge-weighted
digraph:

    (A)<-----14-----(B)<-----15-----(C)------55---->(D)
     ^              /^              ^|              ^^
     |             / |             / |             / |
     |            /  |            /  |            /  |
     |           /   |           /   |           /   |
     |          /    |          /    |          /    |
     |         /     |         /     |         /     |
     |        /      |        /      |        /      |
     29      2       40      19      38      12      2
     |      /        |      /        |      /        |
     |     /         |     /         |     /         |
     |    /          |    /          |    /          |
     |   /           |   /           |   /           |
     |  /            |  /            |  /            |
     | /             | /             | /             |
     |v              |/              v/              |
    (E)<-----9------(F)------65---->(G)------32---->(H)

Here is the distTo[] array before F is relaxed:

           v     A   B   C   D   E   F   G   H
    ----------------------------------------
    distTo[v]    -   -   -   -   -   0   -   -
```

Suppose that you run the acyclic shortest paths algorithm to compute the shortest paths from F to every other vertex using the following topological order:

F C G H D B E A

Give the sequence of 8 integers in the distTo[] array immediately after vertex B is relaxed.

48 34 19 69 9 0 57 89

Correct Response

```
The correct answer is: 48 34 19 69 9 0 57 89


Here is the initial distTo[] array:

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -   -   -   -   -   0   -   -


Here is the distTo[] array after vertex F is relaxed:
[  edge relaxations that change the distTo[] array:  F->G  F->B  F->E
     F->C  ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -  40  19   -   9   0  65   -


Here is the distTo[] array after vertex C is relaxed:
[  edge relaxations that change the distTo[] array:  C->B  C->G  C->D
     ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -  34  19  74   9   0  57   -


Here is the distTo[] array after vertex G is relaxed:
[  edge relaxations that change the distTo[] array:  G->H  G->D  ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -  34  19  69   9   0  57  89


Here is the distTo[] array after vertex H is relaxed:
[  no changes in the distTo[] array ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -  34  19  69   9   0  57  89


Here is the distTo[] array after vertex D is relaxed:
[  no changes in the distTo[] array ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]    -  34  19  69   9   0  57  89


Here is the distTo[] array after vertex B is relaxed:
[  edge relaxations that change the distTo[] array:  B->A  ]

            v     A   B   C   D   E   F   G   H
     ---------------------------------------
     distTo[v]   48  34  19  69   9   0  57  89
```

0 / 1
points

3.

```
(seed = 863998)
Consider the following edge-weighted digraph with 8 vertices
and 13 edges.

    v->w  weight
    ------------
    A->E    17
    B->F    34
    B->A    24
    C->B    26
    C->F    66
    D->G    16
    D->C     8
    D->H     2
    E->F     4
    F->G     1
    F->A     2
    G->C     2
    H->G    21


Here is a graphical representation of the same edge-weighted digraph:

    (A)<-----24-----(B)<-----26-----(C)<-----8------(D)
     |^              |              /^              /|
     | \             |             / |             / |
     |  \            |            /  |            /  |
     |   \           |           /   |           /   |
     |    \          |          /    |          /    |
     |     \         |         /     |         /     |
     |      \        |        /      |        /      |
     17      2       34      66      2       16      2
     |        \      |      /        |      /        |
     |         \     |     /         |     /         |
     |          \    |    /          |    /          |
     |           \   |   /           |   /           |
     |            \  |  /            |  /            |
     |             \ | /             | /             |
     v              \vv              |v              v
    (E)------4----->(F)------1----->(G)<-----21-----(H)

Here is the distTo[] array before the beginning of pass 0:

           v     A   B   C   D   E   F   G   H
    ----------------------------------------
    distTo[v]    -   -   -   0   -   -   -   -
```

Suppose that you run the Bellman-Ford algorithm to compute the shortest paths from D to every other vertex. Give the sequence of 8 integers in the distTo[] array immediately after the end of three passes of the algorithm (pass 0, 1, and 2). Each pass consists of relaxing the 13 edges in the order given above.

58 34 8 0 95 68 16 2

Incorrect Response