Test: Single source shortest paths 2021

Due Dec 2, 2021 at 3:55pm **Points** 60 **Questions** 4
Available Dec 2, 2021 at 2:15pm - Dec 2, 2021 at 4pm about 2 hours
Time Limit 100 Minutes

Instructions

You have maximum 100 minutes for the test, but the deadline is 15:45.

Attention! If an answer consists of a sequence of items, the items must be separated with commas, with no blank. No sign is to be put at the ends of the sequence.
For example: 1,3,4,6
Another example: 3,b

This quiz was locked Dec 2, 2021 at 4pm.

Attempt History

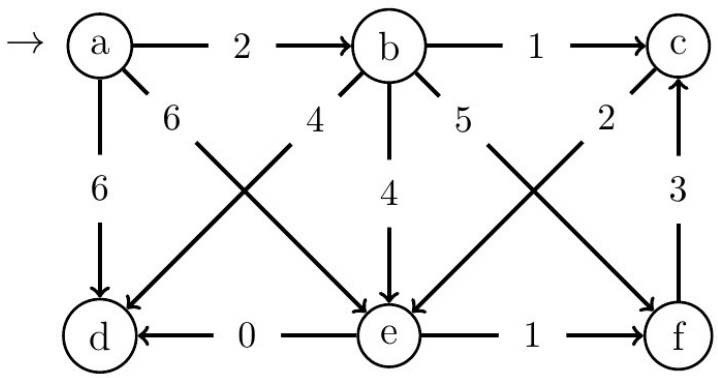
	Attempt	Time	Score
LATEST	Attempt 1	89 minutes	41.88 out of 60

ⓘ Correct answers are no longer available.

Score for this quiz: **41.88** out of 60
Submitted Dec 2, 2021 at 3:45pm
This attempt took 89 minutes.

Partial **Question 1** **5.63 / 15 pts**

Illustrate the Dijkstra algorithm on the graph below as you have seen it at the practice classes. Answer the questions.
Source vertex: a



Consider the result of the algorithm. Which is the greatest d value?

7

Which vertex has this d value?

d

How many vertices remain in Q after removing node **c**? 3

Present the shortest path found by the algorithm from vertex **a** to node **d**.

The path (only the vertices separated with commas, including **a** and **d**):

a,d

The length of the path: 6

Present the final **d** and **π** values of the following vertices (for example: **6,g**).

node **c**: 3,b

node **e**: 6,a

Would the result change, if the weight of edge **(b,f)** were altered form 5 to 4 (yes/no)? yes

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Answer 1:

7

Answer 2:

d

Answer 3:

3

Answer 4:

a,d

Answer 5:

6

Answer 6:

3,b

Answer 7:

6,a

Answer 8:

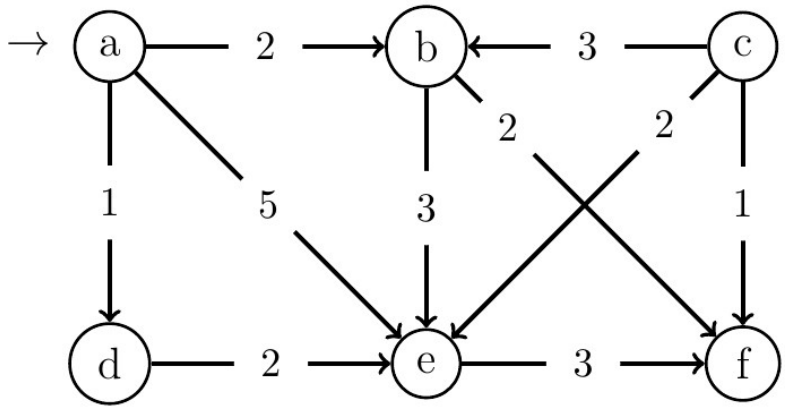
yes

Question 2

15 / 15 pts

Illustrate the *DAG shortest paths* algorithm on the graph below as you have seen it at the practice classes. Answer the questions.

Source vertex: a



The partial topological order of the vertices (which is found by the algorithm):

a,d,b,e,f

Present the shortest path found by the algorithm from vertex **a** to node **f.**

The path (only the vertices separated with commas, including **a** and **f**):

a,b,f

The length of the path: 4

How many vertices are not available from the source vertex?

1

Present the final **d** and **π** values of the following vertices (for example: **6,g**).

node **d**: 1,a

node **e**: 3,d

Would the final result change, if vertices **d** and **b** were processed in different order [in topological sort] (yes / no)? no

Answer 1:

a,d,b,e,f

Answer 2:

a,b,f

Answer 3:

4

Answer 4:

1

Answer 5:

1,a

Answer 6:

3,d

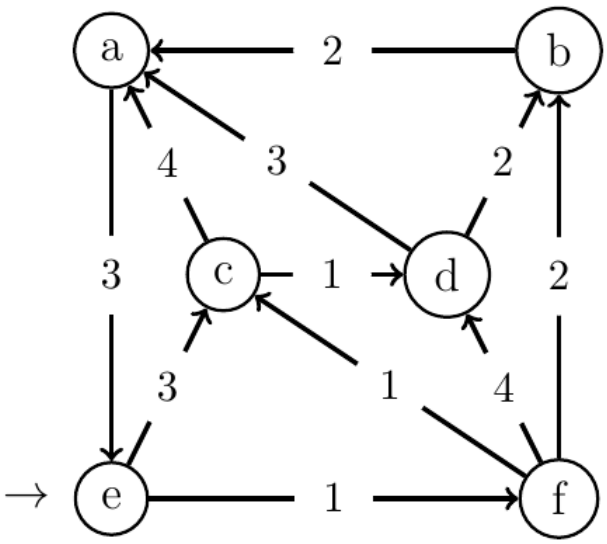
Answer 7:

no

Question 3

15 / 15 pts

Illustrate the *Queue-based Bellman-Ford* algorithm on the graph below as you have seen it at the practice classes. Answer the questions.
Source vertex: **e**



Present the content of the queue after the 1st, 2nd and 3rd iterations of the main loop.

At the end of the 1. iteration: c,f

At the end of the 2. iteration: f,a,d

At the end of the 3. iteration: a,d,b,c

Present the shortest path found by the algorithm from vertex **e** to node **a**.

The path (only the vertices separated with commas, including **e** and **a**): e,f,b,a

The length of the path: 5

How many times the algorithm expands the following vertices?

Node **f**: 1

Node **d**: 2

Present the final **d**, **e** and **π** values of the following vertices (in order **d**,**e**,**π** separated with commas).

Node **d**: 3,3,c

Node **c**: 2,2,f

If we changed the weight of edge **(e,f)** from **1** to **2**, the (**d** or **π)** values of which vertices would change? Enumerate those nodes in alphabetical

order. a,b,c,d,f

Answer 1:

c,f

Answer 2:

f,a,d

Answer 3:

a,d,b,c

Answer 4:

e,f,b,a

Answer 5:

5

Answer 6:

1

Answer 7:

2

Answer 8:

3,3,c

Answer 9:

2,2,f

Answer 10:

a,b,c,d,f

Partial

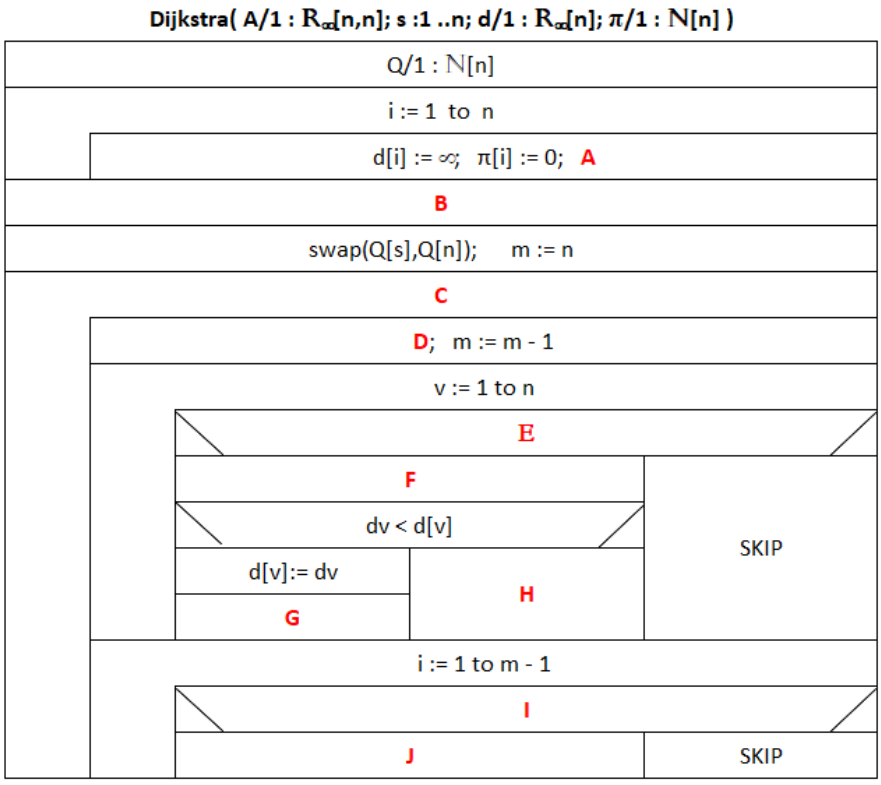
Question 4

6.25 / 15 pts

Write the *Dijkstra* algorithm for *adjacency-matrix* graph representation.

At the following structogram, the nodes of the graph are indexed from **1** to **n**. Parameter **A** is the *adjacency-matrix*. The minimum priority queue is

represented with the first **m** elements of array **Q/1**. It is an invariant property of the main loop, that among the first **m** elements of array **Q**, the **m**th element has minimal **d**-value, i.e. $\forall i \in [1..m) : d[Q[i]] \geq d[Q[m]]$. The first **m-1** elements of **Q** are unsorted.



A : [Select]

B: [Select]

C: [Select]

D: [Select]

E: [Select]

F: [Select]

G: [Select]

H: [Select]

I : [Select]

J: [Select]

Worst-case time complexity (MT): [Select]

Best-case time complexity (mT): [Select]

Answer 1:

d[s] := 0

Answer 2:

m > 1 és d[Q[m]] ≠ végtelen

Answer 3:

u := Q[m]

Answer 4:

A[u,v] =1

Answer 5:

dv := d[v] + A[u,v]

Answer 6:

π[u] := v

Answer 7:

SKIP

Answer 8:

d[Q[i]] > d[Q[m]]

Answer 9:

swap(Q[i],Q[n])

Answer 10:

Θ((n+m)*(log n))

Answer 11:

Θ(n)

Quiz Score: **41.88** out of 60