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EL9343 Homework 12

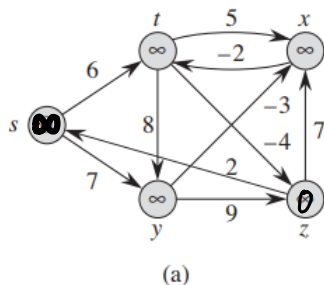
(Due Dec 14th, 2021)

No late assignments accepted

All problem/exercise numbers are for the third edition of CLRS text book

- Exercise 24.1-1
- Exercise 24.2-1, using vertex t as the source
- Exercise 24.3-1, only use t as the source
- Exercise 25.2-1

Q1. ① When using vertex z as the source, return True.



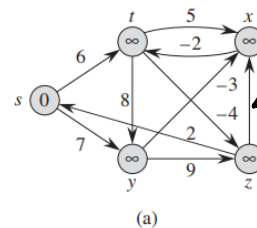
D values:

| s | t | x | y | z |
|---|---|---|---|---|
| ∞ | ∞ | ∞ | ∞ | 0 |
| 2 | ∞ | 7 | ∞ | 0 |
| 2 | 5 | 7 | 9 | 0 |
| 2 | 5 | 6 | 9 | 0 |
| 2 | 5 | 6 | 9 | 0 |

π values: (Update according to the value from last iteration. Total iter = $|V|-1$)

| s | t | x | y | z |
|-----|-----|-----|-----|-----|
| NIL | NIL | NIL | NIL | NIL |
| z | NIL | z | NIL | NIL |
| z | x | z | s | NIL |
| z | x | y | s | NIL |
| z | x | y | s | NIL |

② After change the weight of edge (z,x) to 4:
When using vertex s as the source, Return False



D values:

| s | t | x | y | z |
|---|---|---|---|----|
| 0 | ∞ | ∞ | ∞ | ∞ |
| 0 | 6 | ∞ | 7 | ∞ |
| 0 | 6 | 4 | 7 | 2 |
| 0 | 2 | 4 | 7 | 2 |
| 0 | 2 | 4 | 7 | -2 |

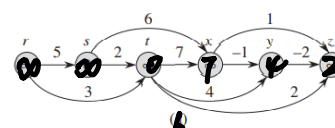
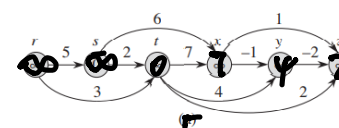
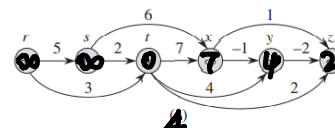
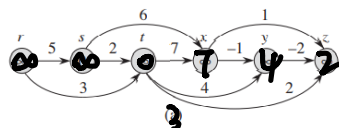
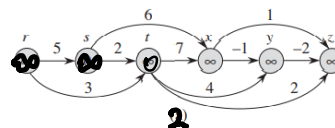
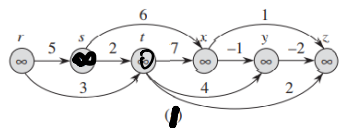
π values:

| s | t | x | y | z |
|-----|-----|-----|-----|-----|
| NIL | NIL | NIL | NIL | NIL |
| NIL | s | NIL | s | NIL |
| NIL | s | y | s | t |
| NIL | x | y | s | t |
| NIL | x | y | s | t |

$\delta(z,x)$:

\Rightarrow check: $\delta(x) = 4 - 2 = 2 < 4$: return False.

Q2.



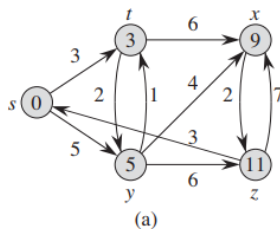
D values:

| r | s | t | x | y | z |
|----------|----------|---|----------|----------|----------|
| ∞ | ∞ | 0 | ∞ | ∞ | ∞ |
| ∞ | ∞ | 0 | ∞ | ∞ | ∞ |
| ∞ | ∞ | 0 | 7 | 4 | 2 |
| ∞ | ∞ | 0 | 7 | 4 | 2 |
| ∞ | ∞ | 0 | 7 | 4 | 2 |
| ∞ | ∞ | 0 | 7 | 4 | 2 |

π values:

| r | s | t | x | y | z |
|-----|-----|-----|-----|-----|-----|
| NIL | NIL | NIL | NIL | NIL | NIL |
| NIL | NIL | NIL | NIL | NIL | NIL |
| NIL | NIL | NIL | t | t | t |
| NIL | NIL | NIL | t | t | t |
| NIL | NIL | NIL | t | t | t |
| NIL | NIL | NIL | t | t | t |

Q3.



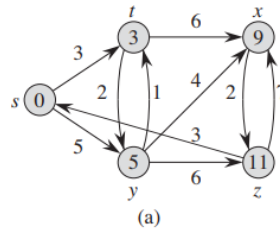
When using vertex t as the resource: [Update D value each time after iteration]

D values:

| s | t | x | y | z |
|----------|---|---|---|----------|
| ∞ | 0 | 6 | 2 | ∞ |
| ∞ | 0 | 6 | 2 | 8 |
| 11 | 0 | 6 | 2 | 8 |
| 11 | 0 | 6 | 2 | 8 |
| 11 | 0 | 6 | 2 | 8 |
| 11 | 0 | 6 | 2 | 8 |

π values:

| s | t | x | y | z |
|-----|-----|---|---|-----|
| NIL | NIL | t | t | NIL |
| NIL | NIL | t | t | t |
| z | NIL | t | t | t |
| z | NIL | t | t | t |
| z | NIL | t | t | t |
| z | NIL | t | t | t |



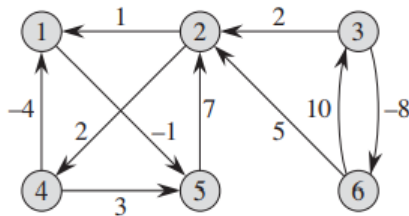
When using vertex z as the resource:
D values:

| s | t | x | y | z |
|---|---|---|---|---|
| 3 | ∞ | 7 | ∞ | 0 |
| 3 | 6 | 7 | 8 | 0 |
| 3 | 6 | 7 | 8 | 0 |
| 3 | 6 | 7 | 8 | 0 |
| 3 | 6 | 7 | 8 | 0 |
| 3 | 6 | 7 | 8 | 0 |

π values:

| s | t | x | y | z |
|---|-----|---|-----|-----|
| z | NIL | z | NIL | NIL |
| z | s | z | s | NIL |
| z | s | z | s | NIL |
| z | s | z | s | NIL |
| z | s | z | s | NIL |
| z | s | z | s | NIL |

Q4.



$$d_{ij}^{(k)} = \begin{cases} w_{ij} & \text{if } k=0. \\ \min(d_{ij}^{(k-1)}, d_{ik}^{(k-1)} + d_{kj}^{(k-1)}) & \text{if } k \geq 1, \end{cases}$$

$k=0$

$$\begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & \infty & \infty \\ \infty & 2 & 0 & \infty & \infty & -8 \\ -4 & \infty & \infty & 0 & 3 & \infty \\ \infty & 7 & \infty & \infty & 0 & \infty \\ \infty & 5 & 10 & \infty & \infty & 0 \end{pmatrix}$$

$k=1$

$$\begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ \infty & 2 & 0 & \infty & \infty & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ \infty & 7 & \infty & \infty & 0 & \infty \\ \infty & 5 & 10 & \infty & \infty & 0 \end{pmatrix}$$

$k=2$

$$\begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ 3 & 2 & 0 & 4 & 2 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix}$$

$k=3$

$$\begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ 3 & 2 & 0 & 4 & 2 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix}$$

$k=4$

$$\begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ -2 & 0 & \infty & 2 & -3 & \infty \\ 0 & 2 & 0 & 4 & -1 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 5 & 7 & \infty & 9 & 0 & \infty \\ 3 & 5 & 10 & 7 & 2 & 0 \end{pmatrix}$$

$k=5$

$$\begin{pmatrix} 0 & 6 & \infty & 8 & -1 & \infty \\ -2 & 0 & \infty & 2 & -3 & \infty \\ 0 & 2 & 0 & 4 & -1 & -8 \\ -4 & +2 & \infty & 0 & -5 & \infty \\ 5 & 7 & \infty & 9 & 0 & \infty \\ 3 & 5 & 10 & 7 & 2 & 0 \end{pmatrix}$$

$k=6$

$$\begin{pmatrix} 0 & 6 & \infty & 8 & -1 & \infty \\ -2 & 0 & \infty & 2 & -3 & \infty \\ -5 & -3 & 0 & -1 & -6 & -8 \\ -4 & +2 & \infty & 0 & -5 & \infty \\ 5 & 7 & \infty & 9 & 0 & \infty \\ 3 & 5 & 10 & 7 & 2 & 0 \end{pmatrix}$$