Homework 3

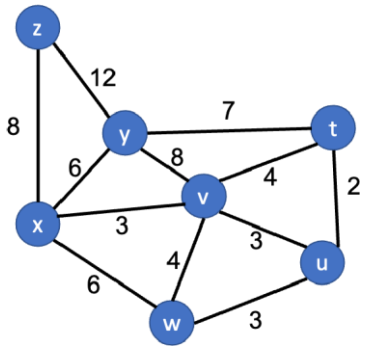
CSE 310 Fall 2021

Due date: **November 9, 2021; 11:59 PM**

Submission via Blackboard.

1. Dijkstra's algorithm

A. Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from *x* to all network nodes. Show how the algorithm works by computing a table similar to the ones discussed in class. **(15 points)**



Step	N'	D(t),p(t)	D(u),p(u)	D(v),p(v)	D(w),p(w)	D(y),p(y)	D(z),p(z)
0	x	∞	∞	**3,x**	6,x	6,x	8,x
1	xv	7,v	**6,v**	3,x	6,x	6,x	8,x
2	xvu	7,v	6,v	3,x	**6,x**	6,x	8,x
3	xvuw	7,v	6,v	3,x	6,x	**6,x**	8,x
4	xvuwy	**7,v**	6,v	3,x	6,x	6,x	8,x
5	xvuwyt	7,v	6,v	3,x	6,x	6,x	**8,x**
6	xvuwytz	7,v	6,v	3,x	6,x	6,x	8,x

x to t: xvt,7(path,distance); x to u: xvu,6; x to v: xv, 3; x to w: xw, 6; x to y: xy, 6; x to z: xz, 8

B. For the same network as part A, using Dijkstra's algorithm, and showing your work similar to part A, compute the shortest path from *t* to all network nodes. **(10 points)**

Step	N'	D(z),p(z)	D(x),p(x)	D(w),p(w)	D(u),p(u)	D(v),p(v)	D(y),p(y)
0	t	∞	∞	∞	**2,t**	4,t	7,t
1	tu	∞	∞	5,u	2,t	**4,t**	7,t
2	tuv	∞	7,v	**5,u**	2,t	4,t	7,t
3	tuvw	∞	**7,v**	5,u	2,t	4,t	7,t
4	tuvwx	15,x	7,v	5,u	2,t	4,t	**7,**t
5	tuvwxy	**15,x**	7,v	5,u	2,t	4,t	7,t
6	tuvwxyz	15,x	7,v	5,u	2,t	4,t	7,t

t to z: tvxz,15;

t to x: tvx, 7;

t to w: tuw,5;

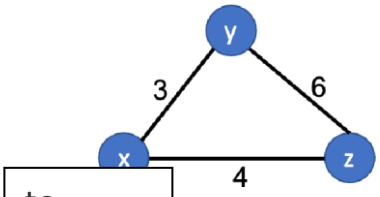
t to u: tu, 2;

t to v: tv,4;

t to y: ty,7

2. Distance vector

A. Consider the three-node topology shown below. Compute the distance tables after the initialization step and after each iteration of a synchronous version of the distance-vector algorithm, similar to our discussion in class. **(10 points)**



Node x:

to

from

After initialization:

	x	y	z
x	0	3	4
y	∞	∞	∞
z	∞	∞	∞

After first iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

After second iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

Node y:

After initialization:

	x	y	z
x	∞	∞	∞
y	4	0	6
z	∞	∞	∞

After first iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

After second iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

Node z:

After initialization:

	x	y	z
x	∞	∞	∞
y	∞	∞	∞
z	4	6	0

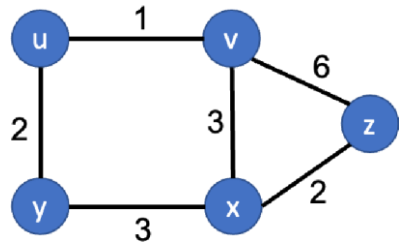
After first iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

After second iteration:

	x	y	z
x	0	3	4
y	3	0	6
z	4	6	0

B. Consider the network shown below and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node *z* for each iteration. **(15 points)**



from / to

	u	v	x	y	z
v	∞	∞	∞	∞	∞
x	∞	∞	∞	∞	∞
z	∞	6	2	∞	0

	u	v	x	y	z
v	1	0	3	∞	6
x	∞	3	0	3	2
z	7	5	2	5	0

	u	v	x	y	z
v	1	0	3	3	5
x	4	3	0	3	2
z	6	5	2	5	0

	u	v	x	y	z
v	**1**	**0**	**3**	**3**	**5**
x	**4**	**3**	**0**	**3**	**2**
z	**6**	**5**	**2**	**5**	**0**