

Homework 4

1. Adjacency Matrix

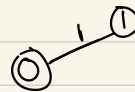
	1	2	3	4	5
1	0	1	1	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	1	0	0	1
5	0	1	1	0	0

2. Step 0 Has the minimum spanning tree

Step 1:

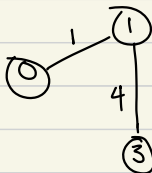
$S = \{0\}$
 $V_S = \{1, 2, 3, 4, 5, 6\}$
 $A = \{\}$
 Lightest Edge: $\{01\}$

Step 2:



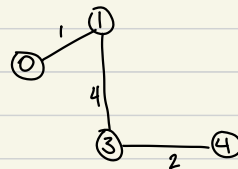
$S = \{0, 1\}$
 $V_S = \{2, 3, 4, 5, 6\}$
 $A = \{01\}$
 lightest: $\{13\}$

Step 3:



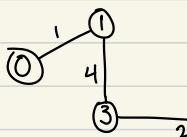
$S = \{0, 1, 3\}$
 $V_S = \{2, 4, 5, 6\}$
 $A = \{01, 13\}$
 lightest: $\{34\}$

Step 4:



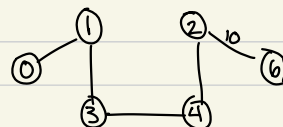
$S = \{0, 1, 3, 4\}$
 $V_S = \{2, 5, 6\}$
 $A = \{01, 13, 34\}$
 lightest: $\{24\}$

Step 5:



$S = \{0, 1, 3, 2, 4\}$
 $V_S = \{5, 6\}$
 $A = \{01, 13, 34, 42\}$
 lightest: $\{26\}$

Step 6:



$S = \{0, 1, 2, 3, 4, 6\}$
 $V_S = \{5\}$
 $A = \{01, 13, 34, 42, 26\}$

No lightest Edge

3) a)
$$\begin{matrix} & a & b & c & d & e \\ \begin{matrix} a \\ b \\ c \\ d \\ e \end{matrix} & \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

b) source vertex is a

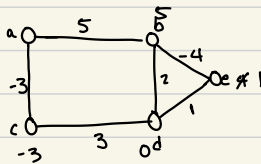
$$n=5$$

$$\text{no. of relaxations} = n-1 = 5-1 = 4$$

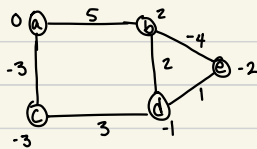
list of edges:

(a,b), (a,c), (d,b), (c,d), (b,e), (e,d)

relaxing all edges 4 times



After relaxing:



pass 2: continue to relax given edges

(a,b) (a,c) (d,b) (c,d) (b,e) (e,d)

(a,b) $0+5 < 5$

(a,c) $0-3 < -3$

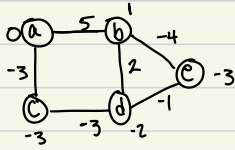
(d,b) $0+2 < 5$

(c,d) $-3+3 < 0$

(b,e) $2-4 < 1$
 $-2 < 1$

(e,d) $-2+1 < 0$

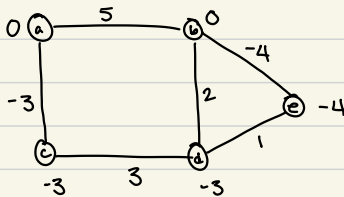
Graph after pass 2



Pass 3:

- (a,b) $0+5 > 2$
- (a,c) $0-3 < 3$
- (d,b) $-1+2 < 2$
- (c,d) $-3+3 > 1$
- (b,e) $-1+4 < -2$
- (e,d) $-3+1 < -1$

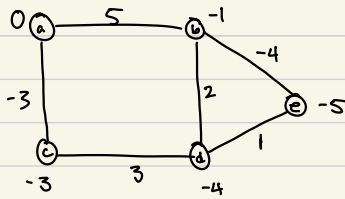
Graph after Pass 3



Pass 4:

- (a,b) $0+5 < 1$
- (a,c) $0-3 < -3$
- (d,b) $-2+2 < 1$
- (c,d) $-3+3 < -2$
- (b,e) $0-4 < -3$
- (e,d) $-4+1 < -2$

Graph after Pass 4:



Pass 5

$$(a, b) \quad 0 + 5 < 0$$

$$(a, c) \quad 0 - 3 < -3$$

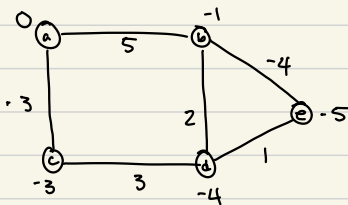
$$(d, b) \quad -3 + 2 < 0$$

$$(c, d) \quad -3 + 3 < -3$$

$$(b, e) \quad -1 - 4 < -4$$

$$(e, d) \quad -5 + 1 < -3$$

Graph after Pass 5



The distances changed, so we can conclude that this contains a negative edge.