EX 4.1

(1).

0 → ~~4371~~
1 → $\boxed{4371}$
2
3 → $\boxed{1323}$ → $\boxed{6173}$
4 → $\boxed{4344}$.
5
6
7
8
9 → $\boxed{4199}$ → $\boxed{9679}$ → $\boxed{1989}$

(2). suppose the slots range from 0 to 12 (you can change 12 to any value).

0	1	2	3	4	5	6	7	8	9	10	11
	4371		1323	6173	4344				4199	9679	1989

(3). suppose quadratic hash. $h(k, i) = (h(k) + i + i^2) \pmod{m}$.

here $h(k) = k \bmod 10$. $m = 12$.

0	1	2	3	4	5	6	7	8	9	10	11
	4371		1323	4344	6173				4199	1989	9679

$h(1989, 0) = 9$

$h(1989, 1) = 11$

$h(1989, 2) = 3$.

$h(1989, 3) = 9$

$h(1989, 4) = (9 + 4 + 16) \bmod (12) = 5$.

$h(1989, 5) = (9 + 5 + 25) \bmod 12 = 3$

$h(1989, 6) = (9 + 6 + 36) \bmod 12 = 3$.

$h(1989, 7) = (9 + 56) \bmod 12 = 5$.

$h(1989, 8) = (9 + 72) \bmod 12 = 9$

$h(1989, 9) = (9 + 90) \bmod 12 = 3.$

$h(1989, 10) = (9 + 110) \bmod 12 = 11$

(4). $h(k, i) = (h_1(k) + i \cdot h_2(k)) \bmod m.$

$m = 13.$

0	1	2	3	4	5	6	7	8	9	10	11	12
	4371	1989	1323	6173			4344		4199		9679	

$h(6173, 1) = (3 + 7 - (6173 \bmod 7)) \bmod 13$

$= (10 - 6) \bmod 13 = 4.$

$h(4344, 1) = (4 + 7 - (4344 \bmod 7)) \bmod 13$

$= 7$

$h(9679, 1) = (9 + 7 - (9679 \bmod 7)) \bmod 13$

$= 11$

$h(1989, 1) = (9 + 7 - (1989 \bmod 7)) \bmod 13$

$= 15 \bmod 13 = \cancel{4}\,2$

$h(\cancel{1989, 2}) = \cancel{(9 + [7 - (1989 \bmod 7)] \times 2) \bmod 13}$

$= \cancel{(9 +}$

(5) ~~refre~~ refer in Lecture Note.

EX 4.14.

(1) unorder lists.

$O(N^2)$. when all keys have the same. hash value, and not allow duplicate keys. otherwise. $O(N)$.

(2) order lists.

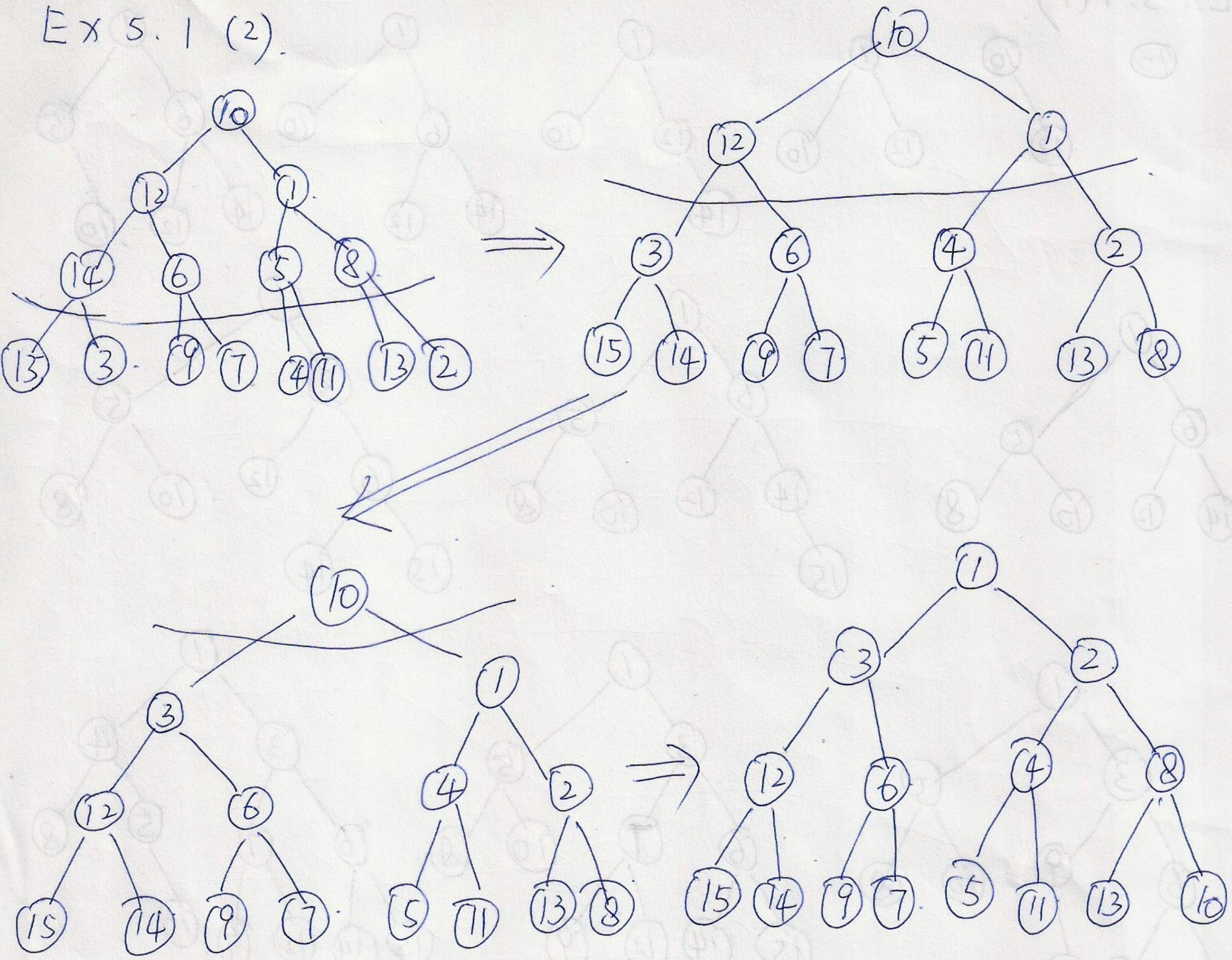
with self-balancing tree. worst case. time is $O(N \log N)$.. otherwise $O(N^2)$

EX 4.15.

~~$O(N^2)$~~ $O(N^2)$ when all keys have the same hash value.

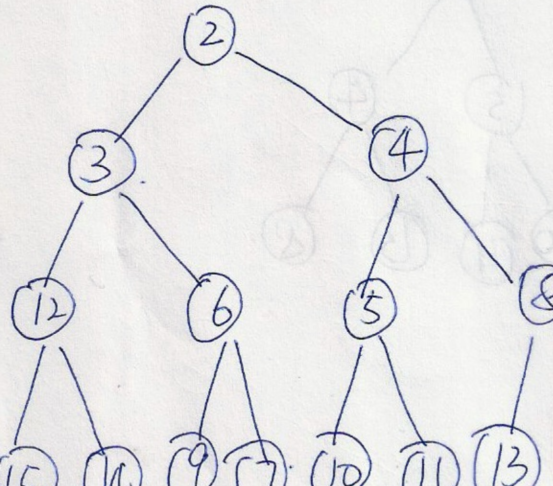
EX 5.1(1).

Ex 5.1 (2).

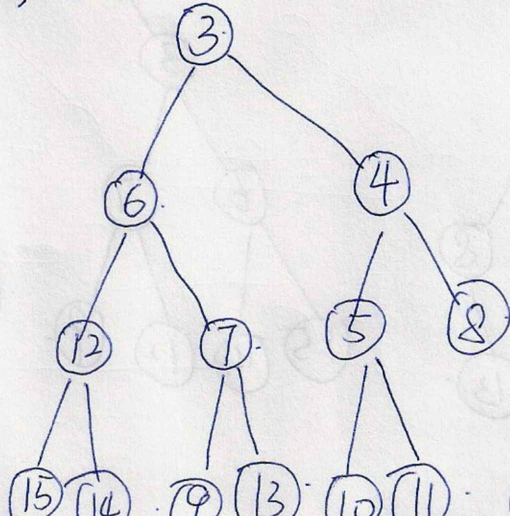


Ex 5.2

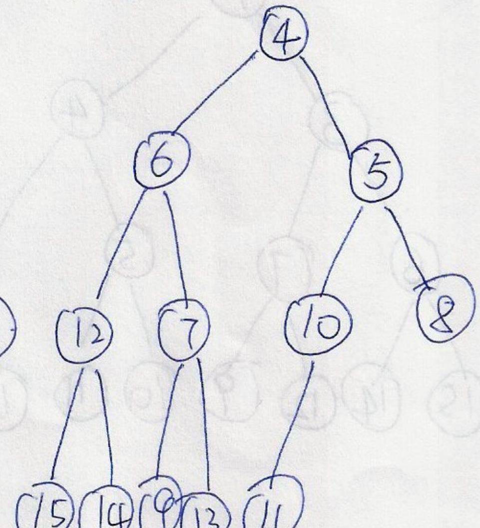
Del 1:



Del 2:



Del 3:



Ex 6.1. (1).

142 543 123 65 453 879 572

434 111 242 811 102.

142: 123, 65, 111, 102.

543: 125, 65, 453, 434, 111, 242, 102.

123: 65, 111, 102.

453: 434, 111, 242, 102.

879: 572, 434, 111, 242, 811, 102.

572: 434, 111, 242, 102.

434: 111, 242, 102.

111: 102.

242: 102.

811: 102.

therere 34 pairs in total.

(2).

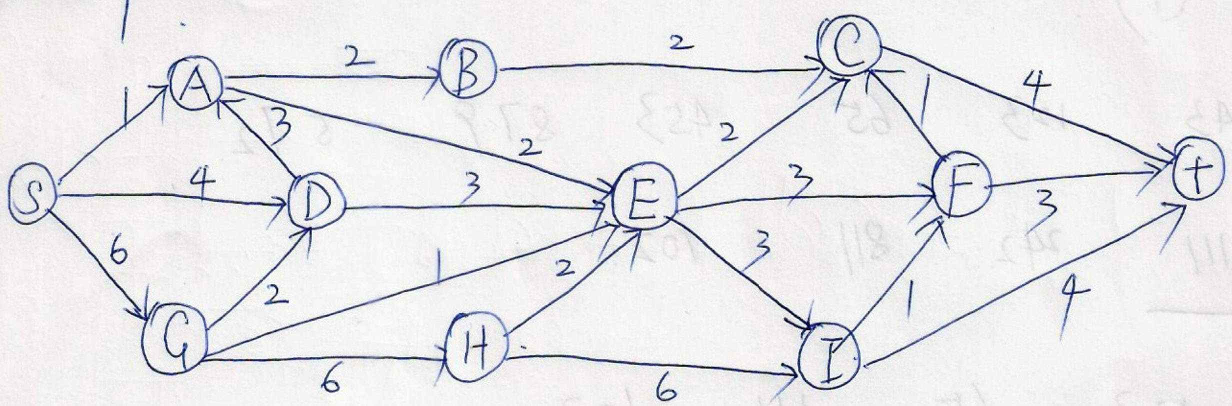
$$(n-1)+(n-2)+\cdots+1=\frac{n(n-1)}{2}.$$

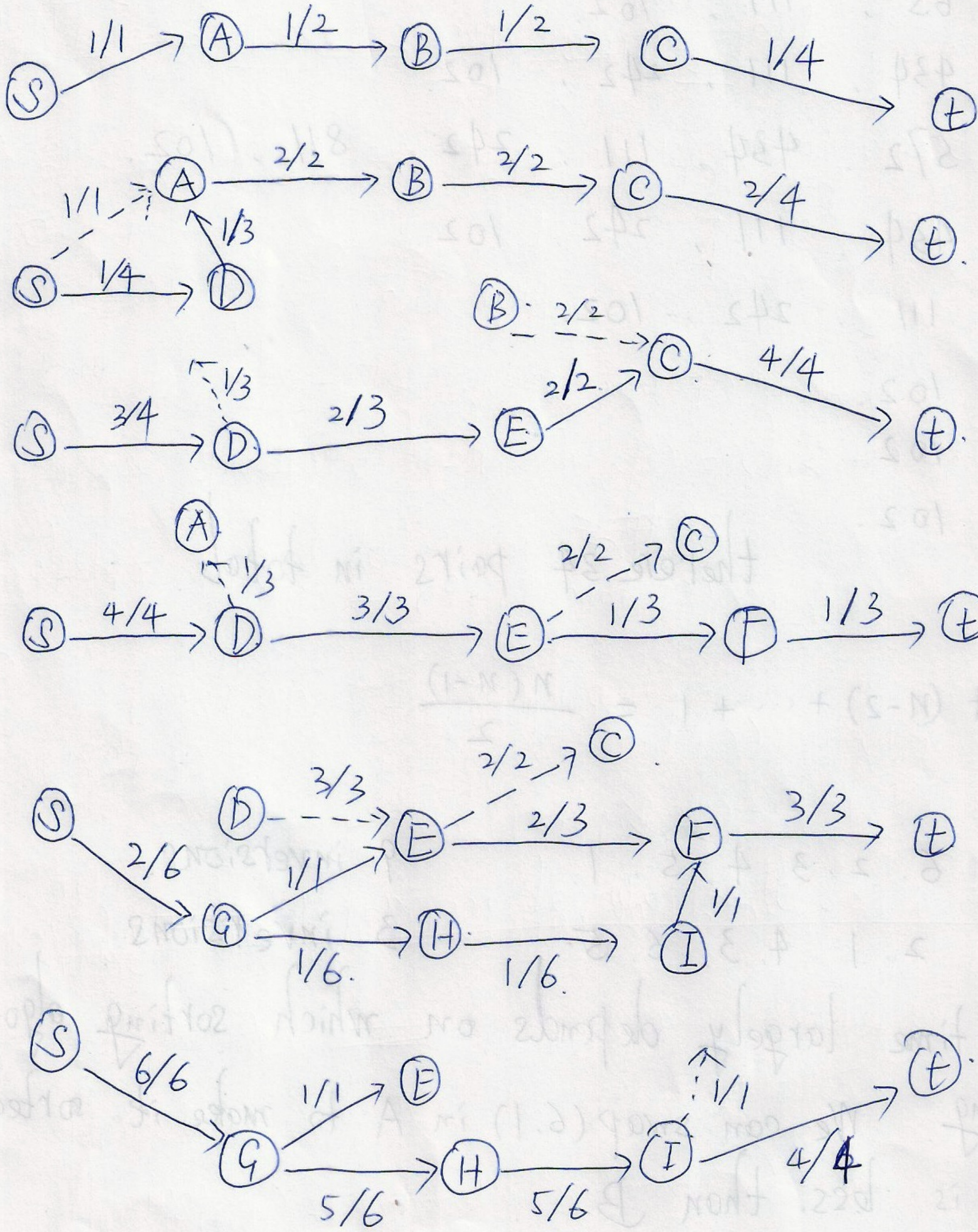
(3). A: 6. 2. 3. 4. 5. 1. 9 inversions.

B: 2. 1. 4. 3. 6. 5. 3 inversions

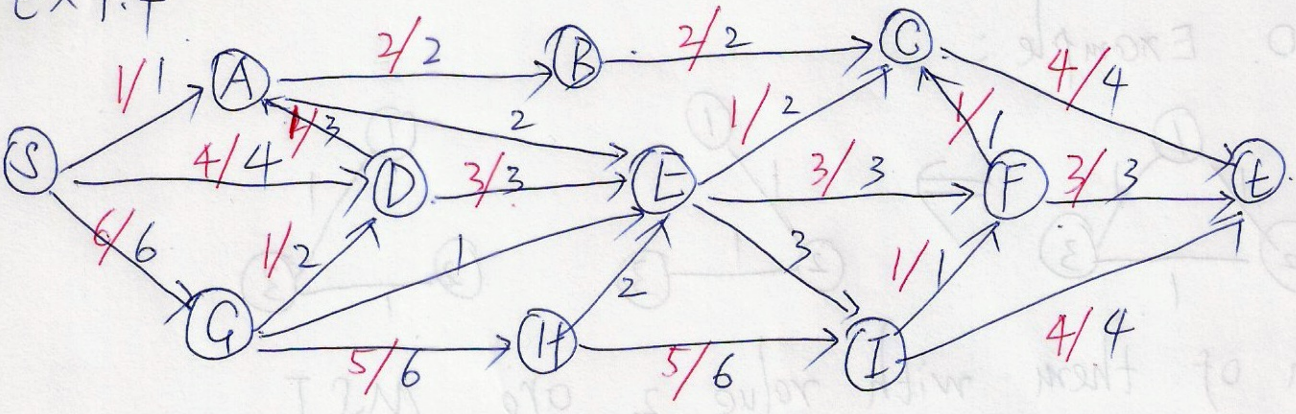
running time largely depends on which sorting algorithm you're using. We can swap (6.1) in A to make it sorted. Which is less than B.

Ex 7.4





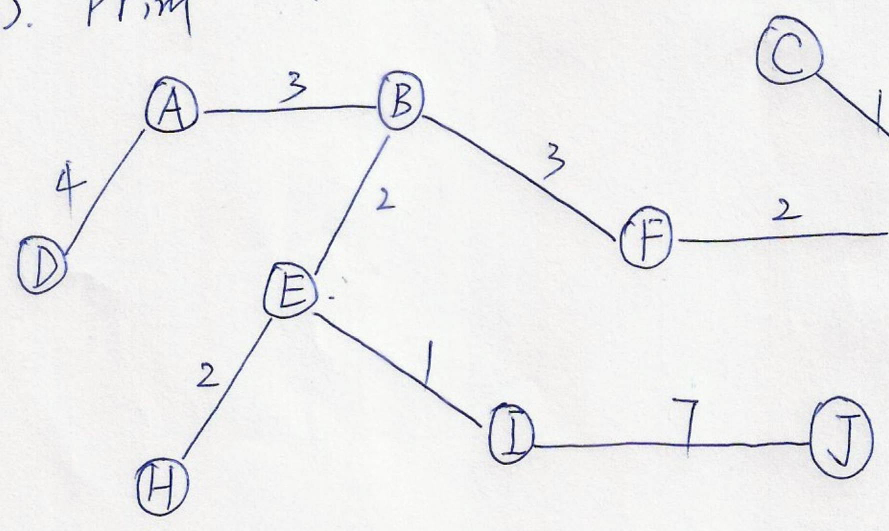
Ex 7.4



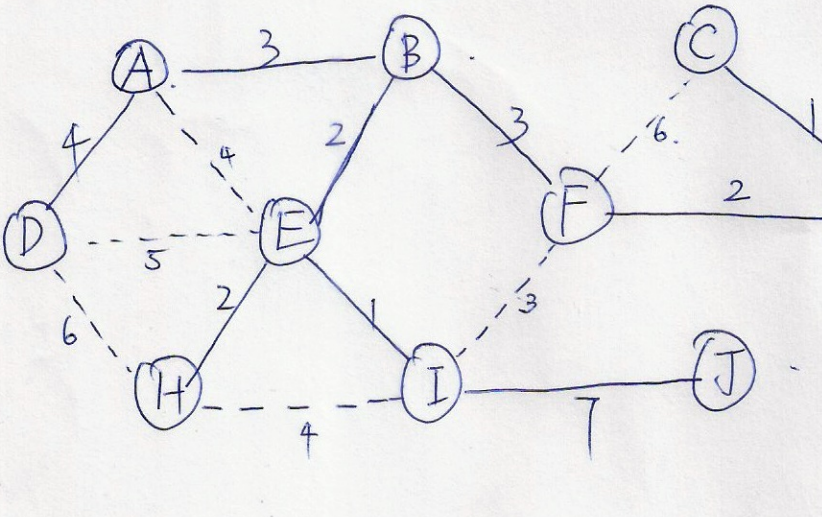
the max-flow is. $4+3+4=11$

Ex 7.5.

(1). Prim



kruskal.



edge to consider in ↑.

(C G). (E. I)

(B. E) (F, G) (E, H.

(A. B) (B. F) (F, I).

(H, I) (A. D)(A E).

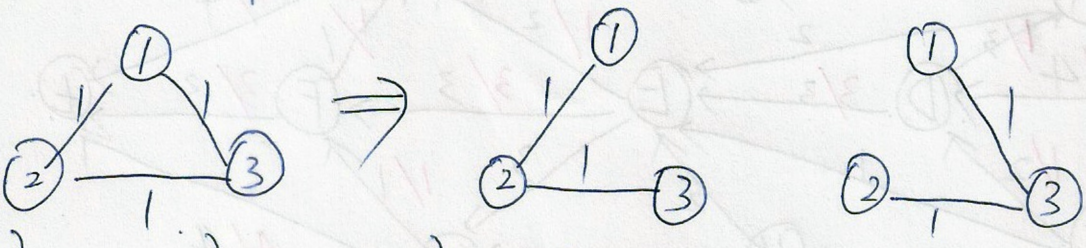
(D, E).

(D, H) (C.F)

(I, J).

EX 7.5

(2.) NO. Example:



Both of them with value 2 are MST.