易頡 91099208Y

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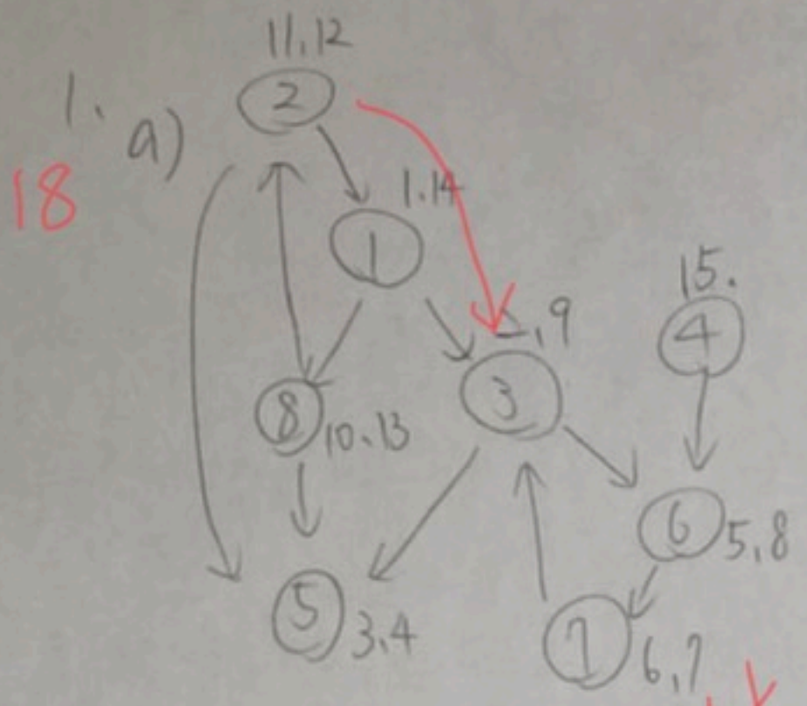
1. a)

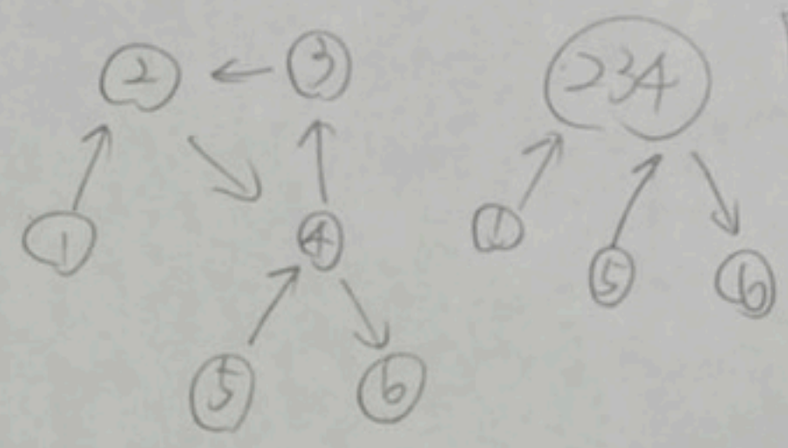


	start	end
1	1	14
2	11	12
3	2	9
4	15	15
5	3	4
6	5	8
7	6	7
8	10	13

+3

b) {2, 1, 8}, {3, 6, 7} ✓

c) 以範例為例 G^T



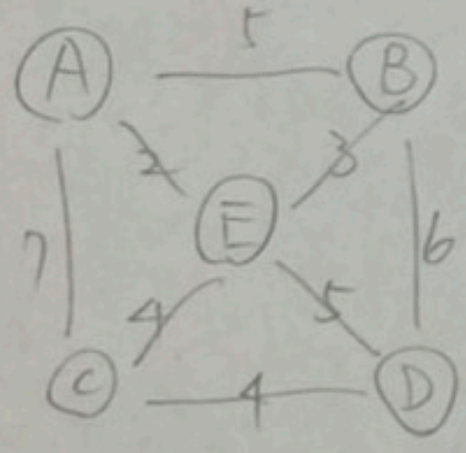
general cases? ✗ +5

因SSC特性，即使transpose後，SSC仍為同組

d) 0 ✓

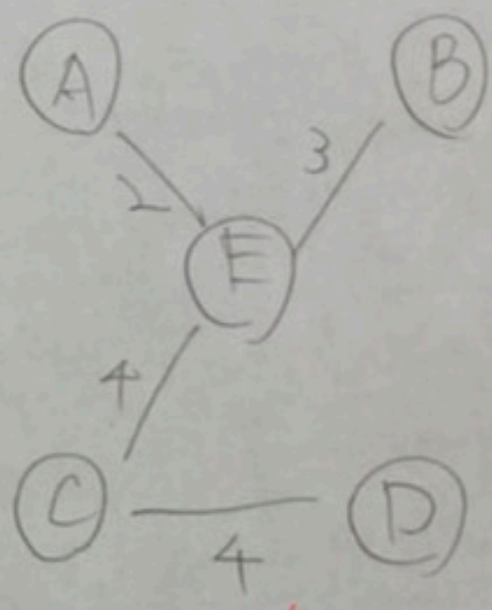
10

2.



a)

A	B	C	D	E
0	A,5	A,7	∞	A,2
0	E,3	E,4	E,5	A,2
0	E,3	E,4	C,4	A,2



✓

b) 並不影響結果，MST最終仍會選擇最小值 ✓

20

3 a) 從i到j的最短路徑，i為起始點，j為終點，k為開放能成為中點的集合 ✓

b) $D^{(1)}$

$$\begin{bmatrix} 0 & 3 & \infty & 2 & 6 \\ 5 & 0 & 4 & 2 & 11 \\ \infty & \infty & 0 & 5 & \infty \\ \infty & \infty & 1 & 0 & 4 \\ 5 & 8 & \infty & 7 & 0 \end{bmatrix}$$

✓

$d_{13}^{(1)} = \min(d_{13}^{(0)}, d_{11}^{(0)} + d_{13}^{(1)}) = \infty$

$d_{14} = \min(d_{14}, d_{11} + d_{14}) = 2$

$d_{15} = \min(d_{15}, d_{11} + d_{15}) = 6$

$d_{21} = \min(d_{21}, d_{21} + d_{11}) = 5$

$d_{23} = \min(d_{23}, d_{21} + d_{13}) = 4$

$d_{24} = \min(d_{24}, d_{21} + d_{14}) = 2$

$d_{25} = \min(d_{25}, d_{21} + d_{15}) = 11$

$d_{32} = \min(d_{32}, d_{31} + d_{12}) = \infty$

$d_{52} = \min(d_{52}, d_{51} + d_{12}) = 8$

$d_{53} = \min(d_{53}, d_{51} + d_{13}) = \infty$

$d_{54} = \min(d_{54}, d_{51} + d_{14}) = 7$

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c) No，陣列值來源可能已經更新，不是上一輪狀態的結果 X

d) Yes，負值並不會影響，因為是最短路徑選擇的關係，最終仍可選到正確最短路徑 ✓

e) 陣列中斜線元素出現負值時，也就是 D[1][1]、D[2][2]、D[3][3]... 即代表有負環 ✓

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4. a) 若直接加上最小值，可能會因為通過的邊數影響結果 無法得到正確的路徑 ✓

b) 加頭減尾，通過 U, V 之最短路徑仍能保持正確路徑 X

c) 可能有負邊的情況下，不能使用 Dijkstra ✓

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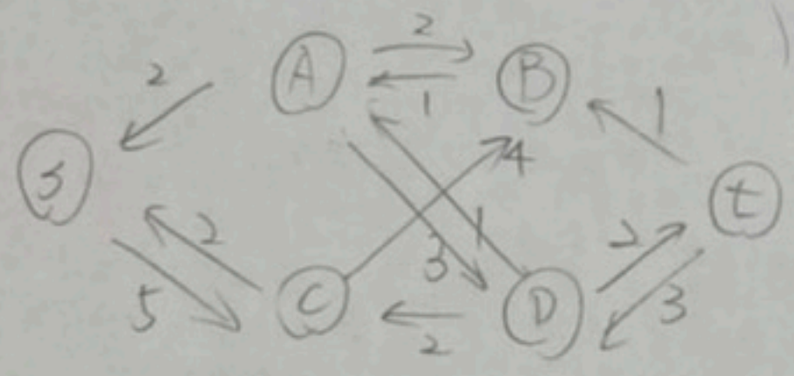
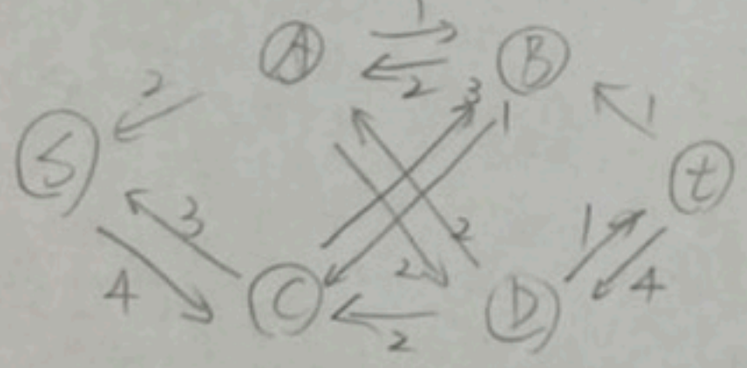
5. a)



✓

b) No, S → C → B → A → D → t, value = 1 ✓



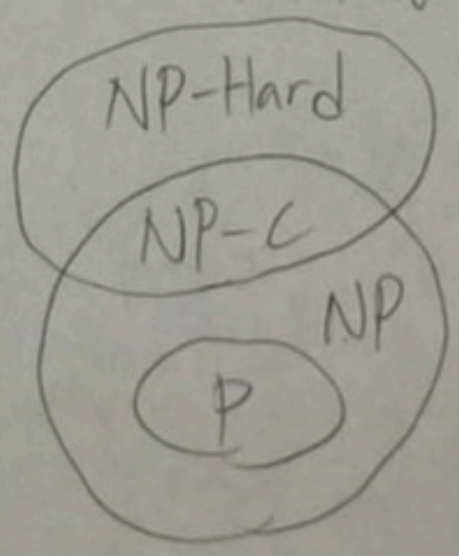
c) 修正之前使用 path 時，過度使用的流量 ✓

d) 額外增加一個起點和終點，分別建立一條到兩組各點長度為 1 的路徑，因為 max flow 的特性，流入＝流出，不能只流出部分，可以避免選到超出 max flow 的情況 ✓

5

6. a) NP-Hard，無法在 Polynomial-time 時間內驗證答案的正確性，而 NP-complete 可以在 polynomial-time 內驗證 ✓

b)



X