

Question 1

- a)
- | | | | |
|-------------------|-----|-----------------|-----|
| $0 \rightarrow 3$ | 3.5 | smallest from 0 | |
| $3 \rightarrow 1$ | 7 | smallest from 3 | NNA |
| $1 \rightarrow 2$ | 9.5 | smallest from 1 | |
| $2 \rightarrow 4$ | 21 | smallest from 2 | |
| $4 \rightarrow 0$ | 9 | smallest from 4 | |

$$0-3-1-2-4-0$$

$$3.5 + 7 + 9.5 + 21 + 9 = \underline{\underline{50}}$$

b) $s_{ij} = c_{oi} + c_{oj} - c_{ij}$

$$s_{12} = 10 + 13.5 - 9.5 = 14$$

$$s_{13} = 10 + 3.5 - 7 = 6.5$$

$$s_{14} = 10 + 9 - 13.5 = 5.5$$

$$s_{23} = 13.5 + 3.5 - 11.5 = 5.5$$

$$s_{24} = 13.5 + 9 - 21 = 1.5$$

$$s_{34} = 3.5 + 9 - 10 = 2.5$$

from the biggest to smallest

s_{12}	s_{13}	s_{14}	s_{23}	s_{34}	s_{24}
✓	✓	✗	✗	✓	✗

$$(1,2): [0-1-0] + [0-2-0] \rightarrow [0-1-2-0]$$

$$(1,3): [0-1-2-0] + [0-3-0] \rightarrow [0-2-1-3-0]$$

$$(3,4): [0-2-1-3-0] + [0-4-0] \rightarrow [0-2-1-3-4-0]$$

$$0-2-1-3-4-0$$

$$13.5 + 9.5 + 7 + 10 + 9 = \underline{\underline{49 \text{ hour}}}$$

Question 2

$$0-2-1-4-3-0$$

a)

old	new	Δ
$(0,2) \quad (4,4) \rightarrow (0,1) \quad (2,4) \rightarrow (10+21) - (13.5+17.5) = +4$		
$(0,2) \quad (4,3) \rightarrow (0,4) \quad (2,3) \rightarrow (9+11.5) - (13.5+10) = -3$		
$(2,1) \quad (4,3) \rightarrow (2,4) \quad (1,3) \rightarrow (21+7) - (9.5+10) = +8.5$		
$(2,1) \quad (3,0) \rightarrow (2,3) \quad (1,0) \rightarrow (11.5+10) - (9.5+3.5) = +8.5$		
$(1,4) \quad (3,0) \rightarrow (1,3) \quad (4,0) \rightarrow (7+9) - (13.5+3.5) = -1$		

$$0-4-1-2-3-0 \quad \text{by } (0,2) \& (4,3) \rightarrow (0,4) \& (2,3)$$

$$9 + 13.5 + 9.5 + 11.5 + 3.5 = 47 \quad \Delta = -3$$

b) $0-4-1-2-3-0$

old	new	Δ
$(0,4) - (1,2) \rightarrow (0,1) - (4,2)$	$(10+21) - (9+9.5) = +12.5$	
$(0,4) - (2,3) \rightarrow (0,2) - (4,3)$	$(13.5+10) - (9+11.5) = +3$	
$(4,1) - (2,3) \rightarrow (4,2) - (1,3)$	$(21+7) - (13.5+11.5) = +3$	
$(4,1) - (3,0) \rightarrow (4,3) - (1,0)$	$(10+10) - (13.5+3.5) = +3$	
$(1,2) - (3,0) \rightarrow (1,3) - (2,0)$	$(7+13.5) - (9.5+3.5) = +7.5$	

$$\Delta > 0$$

there is no better solution

optimal solution $\rightarrow 0-4-1-2-3-0$