104-1 機構設計 Quiz#2 solution

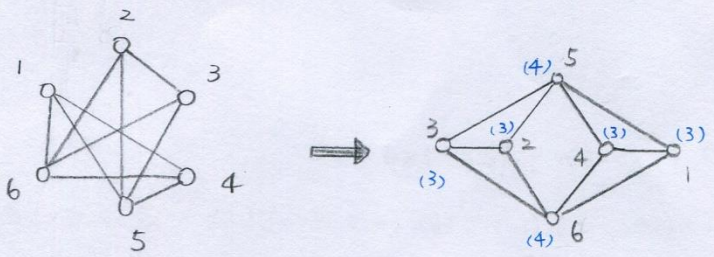
機構設計 Quiz 2

1. (a) $7902 \Rightarrow$ 0 0 1 1 1 1 0 1 1 0 1 1 1 1 0

$$\begin{array}{r|l} 2 & 7902 \quad 0 \\ 2 & 3951 \quad 1 \\ 2 & 1975 \quad 1 \\ 2 & 1987 \quad 1 \\ 2 & 493 \quad 1 \\ 2 & 246 \quad 0 \\ 2 & 123 \quad 1 \\ 2 & 61 \quad 1 \\ 2 & 30 \quad 0 \\ 2 & 15 \quad 1 \\ 2 & 7 \quad 1 \\ 2 & 3 \quad 1 \\ & 1 \end{array}$$

$$\therefore \quad A = \begin{bmatrix} 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 \end{bmatrix}$$

(b)



(c)

$$DM = \begin{bmatrix} 1 & 1 & 1 & 6 & 7 & 7 \\ 1 & 1 & 6 & 1 & 7 & 7 \\ 1 & 6 & 1 & 1 & 7 & 7 \\ 6 & 1 & 1 & 1 & 7 & 7 \\ 7 & 7 & 7 & 7 & 1 & 1 \\ 7 & 7 & 7 & 7 & 1 & 1 \end{bmatrix}$$

(d) $L = J - n + 1 = 10 - 6 + 1 = 5$

(e)

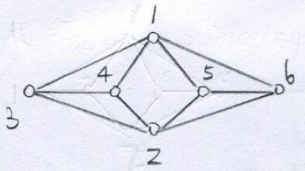
link:	1	2	3	4	5	6
degree:	3	3	3	3	4	4

$d_5 = d_6 > d_1 = d_2 = d_3 = d_4$

renumbering the link:	1	2	3	4	5	6
degree:	4	4	3	3	3	3

number of possible numbering ways: $2! \times 4! = 48$ #

(f)



$$\begin{bmatrix} 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix} \Rightarrow \underline{0111\,11}\ \underline{11\,11}\ \underline{100}\ \underline{00}\ \underline{1}$$

$$\rightarrow 2^{13} + 2^{12} + 2^{11} + 2^{10} + 2^{9} + 2^{8} + 2^{7} + 2^{6} + 2^{5} + 2^{0}$$

$$= 16353 \quad \#$$

(g)

$P_0 = 1$, $P_1 = 0$

$P_2 = -10$

P_3 : (1-4-5), (1-4-6), (2-3-6), (2-3-5) , $P_3 = -2 \times 4 = -8$

P_4 :  : (1-6-4-5), (3-5-4-6), (2-5-3-6), (1-5-2-6), (2-5-4-6), (1-5-3-6) $\Rightarrow -2 \times 6 = -12$

 : 1-6 {2-3, 2-5, 3-5, 4-5} , 1-5 {2-3, 2-6, 3-6, 4-6} , 1-4 {2-3, 2-5, 2-6, 3-5, 3-6} , 4-6 {1-5, 3-5, 2-3, 2-5} , 4-5 {1-6, 3-6, 2-3, 2-6} , 3-6 {1-4, 1-5, 2-5, 4-5} , 3-5 {1-4, 1-6, 4-6, 2-6} , 2-6 {1-4, 1-5, 3-5, 4-5} , 2-3 {1-4, 1-5, 1-6, 4-5, 4-6} , 2-5 {1-4, 1-6, 4-6, 3-6}

$\Rightarrow \frac{1}{2} \times 42 = 21$

$\therefore P_4 = -12 + 21 = 9$

P_5 :  : (1-6-3-5-4), (1-5-3-6-4), (1-6-2-5-4), (1-5-2-6-4), (1-6-3-2-5), (1-5-3-2-6), (1-4-6-2-5), (1-4-5-2-6)

$\Rightarrow -2 \times 8 = -16$

 : 1-4-6 {2-3, 3-5, 2-5} , 1-4-5 {2-3, 3-6, 2-6} , 2-3-6 {1-4, 4-5, 1-5} , 2-3-5 {1-4, 4-6, 1-6} $\Rightarrow 2 \times 12 = 24$

$\therefore P_5 = -16 + 24 = 8$

P_6 :  : (1-4-5-3-2-6), (1-4-6-3-2-5), (1-4-6-2-3-5), (1-4-5-2-3-6) $\Rightarrow -2 \times 4 = -8$

 : (1-6-4-5 & 2-3), (2-5-3-6 & 1-4) $\Rightarrow 2 \times 2 = 4$

 : (1-4-6) & (2-3-5), (1-4-5) & (2-3-6) $\Rightarrow 4 \times 2 = 8$

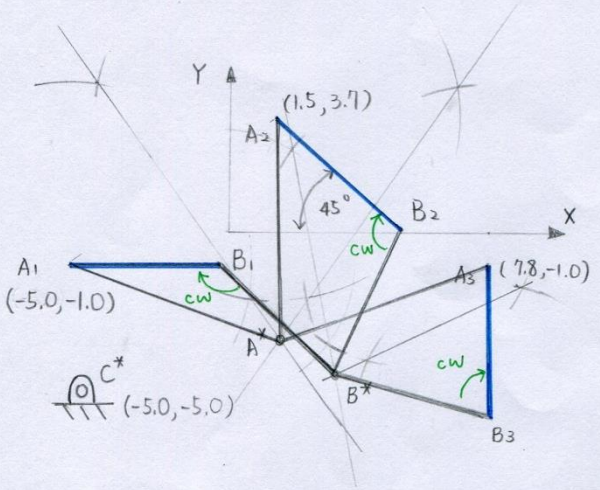
 : (1-6) & (2-3) & (4-5), (1-5) & (2-3) & (4-6), (1-4) & (2-6) & (3-5), (1-4) & (2-5) & (3-6) $\Rightarrow -1 \times 4 = -4$

$\therefore P_6 = -8 + 4 + 8 - 4 = 0$

$$\Rightarrow C_P(A) = x^6 - 10x^4 - 8x^3 + 9x^2 + 8x$$

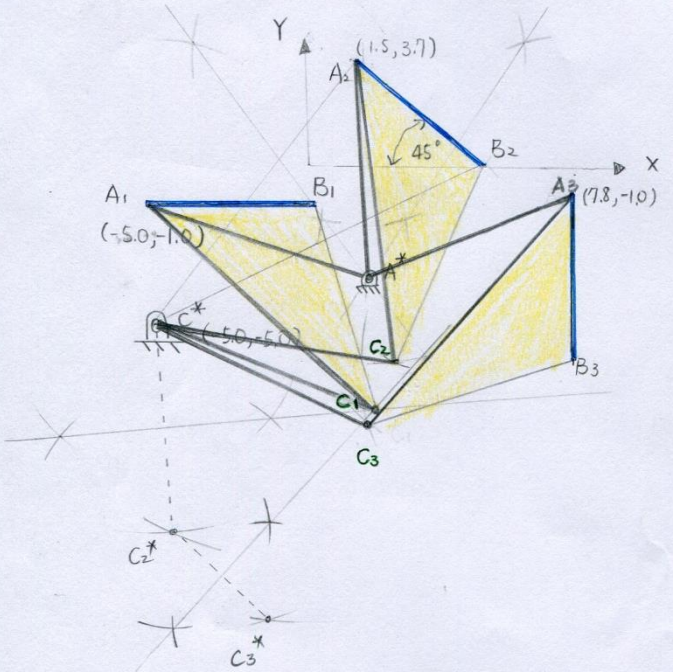
2.

(a)



no change of branch, the mechanism is feasible

(b)



$\overline{A_1A_2}$ 中垂線與 $\overline{A_1A_3}$ 中垂線交點 → A^*

$\triangle A_2B_2C^* \sim \triangle A_1B_1C_2^* \rightarrow C_2^*$

$\triangle A_3B_3C^* \sim \triangle A_1B_1C_3^* \rightarrow C_3^*$

$\overline{C_2^*C_3^*}$ 中垂線與 $\overline{C_2^*C^*}$ 中垂線交點 → C_1

$\triangle A_1B_1C_1 \sim \triangle A_2B_2C_2 \rightarrow C_2$

$\triangle A_1B_1C_1 \sim \triangle A_3B_3C_3 \rightarrow C_3$

∴ four-bar:

(1) $A^*A_1C_1C^*$

(2) $A^*A_2C_2C^*$

(3) $A^*A_3C_3C^*$

1. 50%

(a)、(b)、(c)、(d) 答案錯就全錯。

(e)、(f) 視嘗試計算的程度給分。

(g) 一個係數 3%，扣完 15% 為止。

2. 50%

(a) graph (20%), Change of branch (5%)

(b) graph (20%), four-bar linkage 標示 (5%)