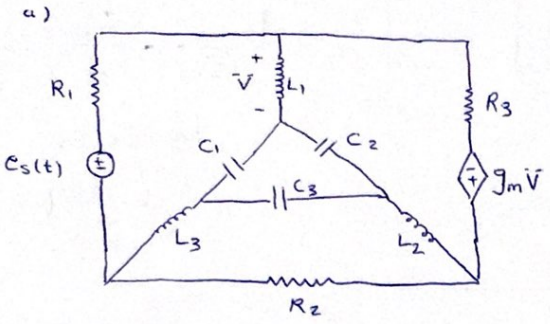
یا لطیف

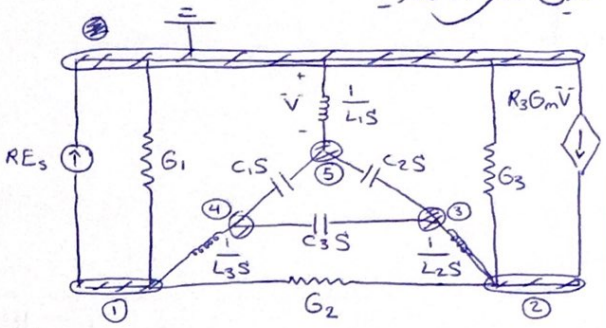
رضا ادیبی پور
۹۸۱۴۳۰۳

تمرین سری ۳: مدار ۲

#1

a)

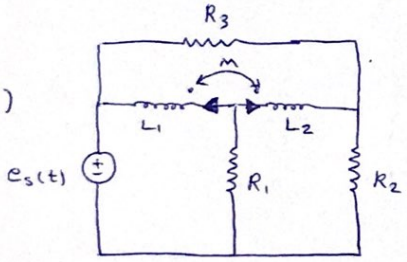


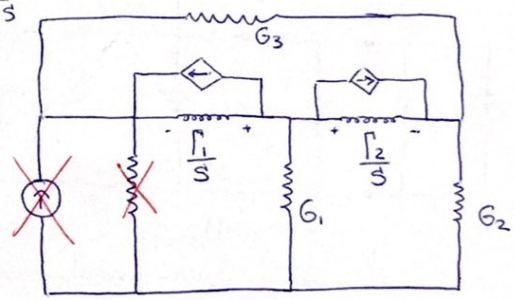


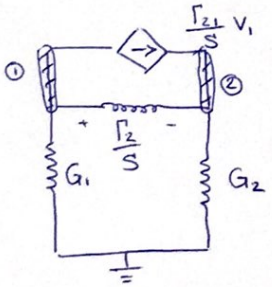
$$\begin{bmatrix} G_1+G_2+\frac{1}{L_3S} & -G_2 & 0 & \frac{-1}{L_1S} & 0 \\ -G_2 & G_2+G_3+\frac{1}{L_2S} & \frac{1}{L_2S} & 0 & +R_3G_mV \\ 0 & \frac{-1}{L_2S} & C_2S+C_3S+\frac{1}{L_2S} & -C_3S & -C_2S \\ \frac{-1}{L_3S} & 0 & -C_3S & C_1S+C_3S+\frac{1}{L_3S} & -C_1S \\ 0 & 0 & -C_2S & -C_1S & C_1S+C_2S+\frac{1}{L_1S} \end{bmatrix} \begin{bmatrix} E_1 \\ E_2 \\ E_3 \\ E_4 \\ E_5 \end{bmatrix} = \begin{bmatrix} -RE_s \\ R_3G_mV \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$V = -E_5$ *

b)

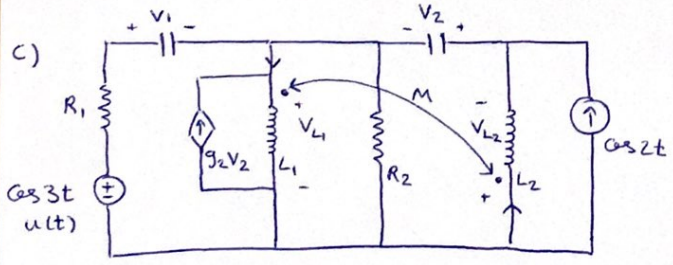


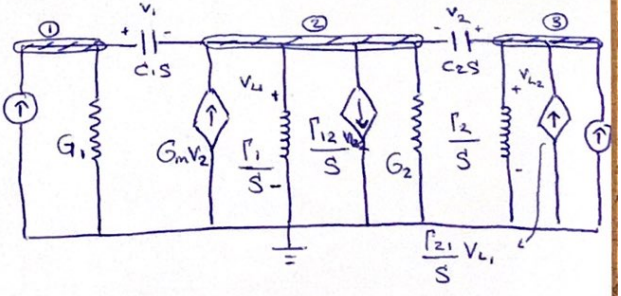




$$\begin{bmatrix} G_1+\frac{\Gamma_2}{S} & -\frac{\Gamma_2}{S} \\ -\frac{\Gamma_2}{S} & G_2+\frac{\Gamma_2}{S} \end{bmatrix} \begin{bmatrix} E_1 \\ E_2 \end{bmatrix} = \begin{bmatrix} -\frac{\Gamma_{21}}{S}V_1 \\ \frac{\Gamma_2}{S}V_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

c)



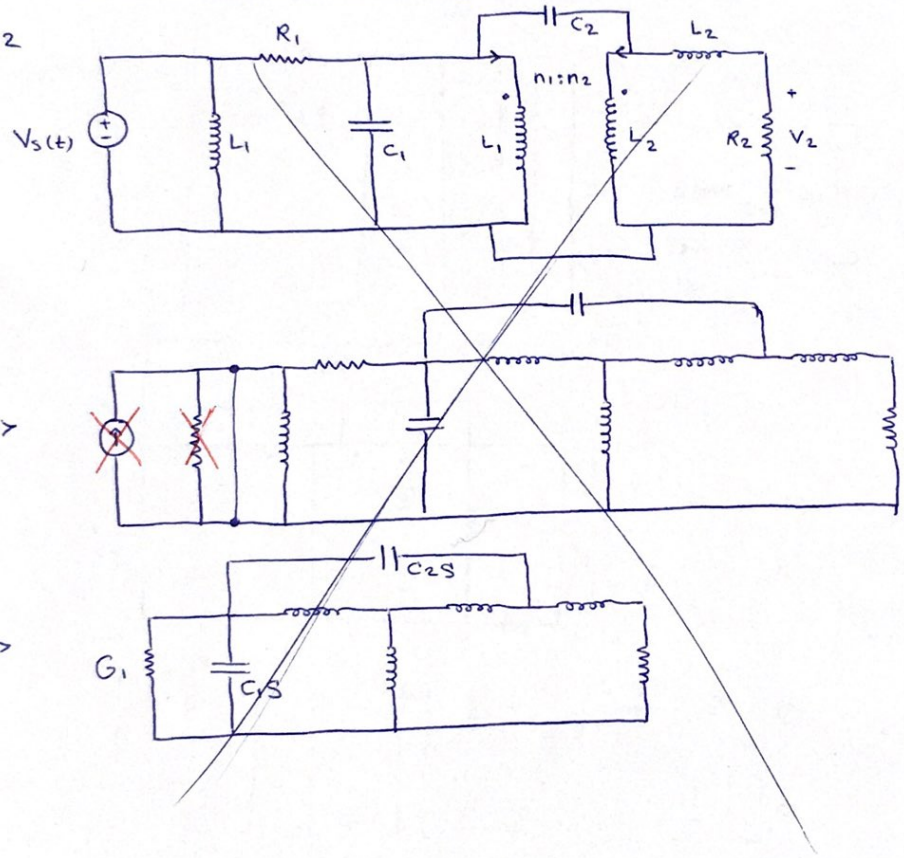


ادامه صفحه بعد
<=

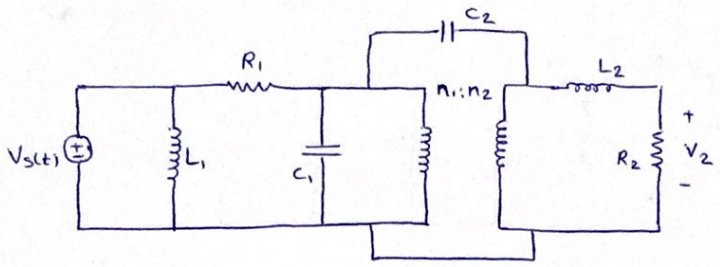
$$\begin{bmatrix} G_1+C_1S & -C_1S & 0 \\ -C_1S & G_m+C_1S+\frac{\Gamma_1}{S}+G_2+C_2S & -G_m-C_2S+\frac{\Gamma_{12}}{S} \\ 0 & -C_2S-\frac{\Gamma_{21}}{S} & C_2S+\frac{\Gamma_2}{S} \end{bmatrix} \begin{bmatrix} E_1 \\ E_2 \\ E_3 \end{bmatrix} = \begin{bmatrix} \frac{R_1S}{S^2+9} \\ G_m V_{L_2} - \frac{\Gamma_{12}}{S} V_{L_2} \\ \frac{S}{S^2+4} + \frac{\Gamma_{21}}{S} V_{L_1} \end{bmatrix}$$

$$V_2 = E_3 - E_2$$
$$V_{L_2} = E_3$$
$$V_{L_1} = E_2$$

#2



#2



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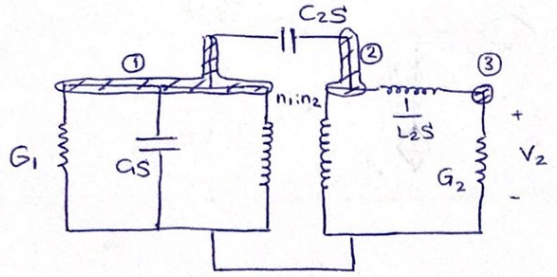
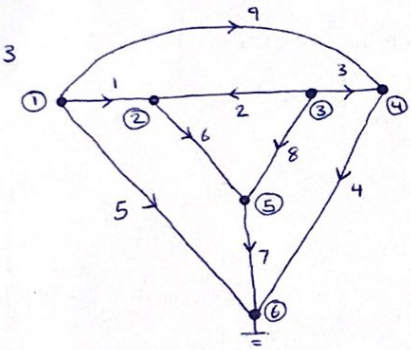


$$\begin{bmatrix} G_1 + C_1 S + C_2 S \end{bmatrix}$$

#3



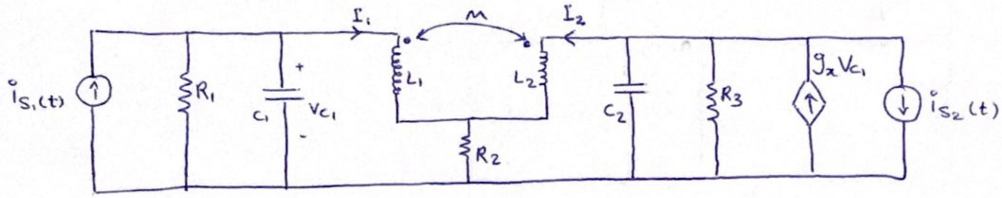
$$A_a = \begin{array}{c} \\ ① \\ ② \\ ③ \\ ④ \\ ⑤ \\ ⑥ \end{array} \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ -1 & -1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & +1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 0 & -1 & 1 & -1 & 0 \\ 0 & 0 & 0 & -1 & -1 & 0 & -1 & 0 & 0 \end{bmatrix}$$

$$A = \begin{array}{c} \\ ① \\ ② \\ ③ \\ ④ \\ ⑤ \end{array} \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ -1 & -1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 0 & -1 & 1 & -1 & 0 \end{bmatrix}$$

$$A\bar{J} = 0 \Rightarrow \begin{array}{c} \\ ① \\ ② \\ ③ \\ ④ \\ ⑤ \end{array} \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ -1 & -1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 0 & -1 & 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} \bar{J}_1 \\ \bar{J}_2 \\ \bar{J}_3 \\ \bar{J}_4 \\ \bar{J}_5 \\ \bar{J}_6 \\ \bar{J}_7 \\ \bar{J}_8 \\ \bar{J}_9 \end{bmatrix} = \begin{cases} ①: \bar{J}_1 + \bar{J}_5 + \bar{J}_9 = 0 \\ ②: -\bar{J}_1 - \bar{J}_2 + \bar{J}_6 = 0 \\ ③: \bar{J}_2 + \bar{J}_3 + \bar{J}_8 = 0 \\ ④: -\bar{J}_3 + \bar{J}_4 - \bar{J}_9 = 0 \\ ⑤: -\bar{J}_6 + \bar{J}_7 - \bar{J}_8 = 0 \end{cases}$$

$$A^T = \begin{bmatrix} 1 & -1 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & -1 \\ 1 & 0 & 0 & -1 & 0 \end{bmatrix} \cdot \begin{bmatrix} E_1 \\ E_2 \\ E_3 \\ E_4 \\ E_5 \end{bmatrix} = \begin{cases} ①: E_1 - E_2 \\ ②: -E_2 + E_3 \\ ③: E_3 - E_4 \\ ④: E_4 \\ ⑤: E_1 \\ ⑥: E_2 - E_5 \\ ⑦: E_5 \\ ⑧: E_3 - E_5 \\ ⑨: E_1 - E_4 \end{cases} = \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_6 \\ V_7 \\ V_8 \\ V_9 \end{bmatrix}$$

4



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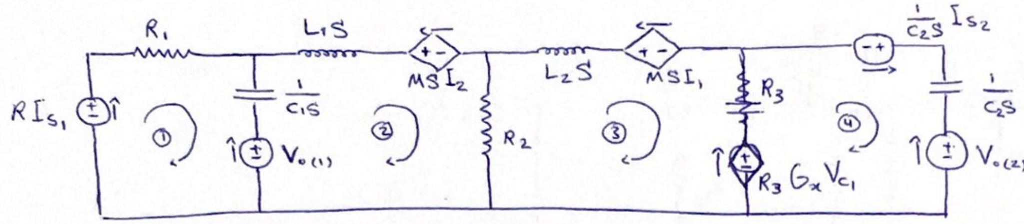


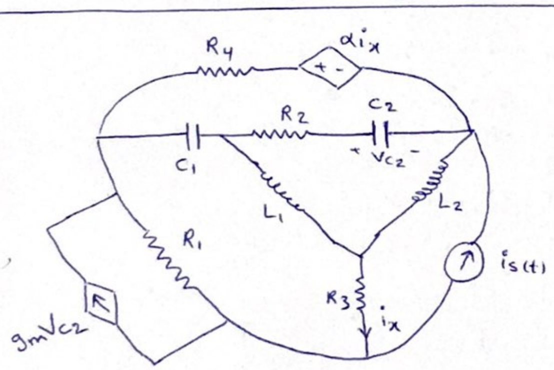
$$
\begin{matrix} ① \\ ② \\ ③ \\ ④ \end{matrix}
\begin{bmatrix}
R_1 + \frac{1}{C_1 S} & \frac{-1}{C_1 S} & 0 & 0 \\
\frac{-1}{C_1 S} & L_1 S + R_2 + \frac{1}{C_1 S} & -R_2 - MS & 0 \\
\frac{R_3 G_x}{C_1 S} + 0 & +MS - R_2 - \frac{R_3 G_x}{C_1 S} & L_2 S + R_3 + R_2 & R_3 \\
0 & 0 & -R_3 & R_3 + \frac{1}{C_2 S}
\end{bmatrix}
\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix}
=
\begin{bmatrix}
R I_{S_1} \\
V_{o(1)} - \cancel{MS I_2} \\
-\cancel{MS I_1} - \cancel{R_3 G_x V_{C_1}} \\
\frac{1}{C_2 S} I_{S_2} - V_{o(2)}
\end{bmatrix}
\begin{matrix} R I_{S_1} \\ V_{o(1)} \\ 0 \\ \\ \end{matrix}
$$

اولیه $I_2 = -I_3$

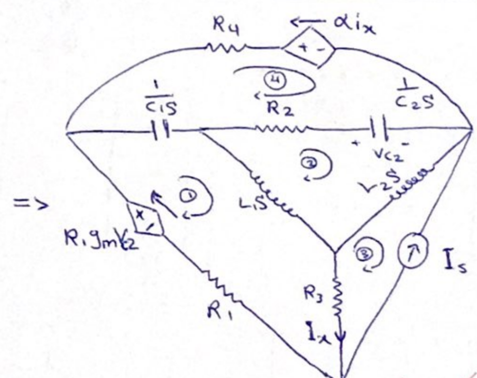
اولیه $I_1 = I_2$

$V_{C_1} = \frac{1}{C_1 S}(I_1 - I_2)$

5



=>



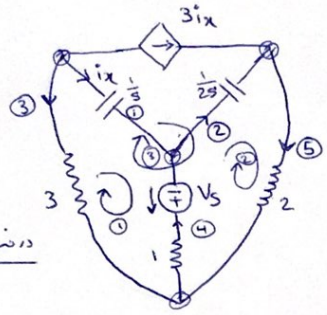
$$
\begin{matrix} ① \\ ② \\ ③ \\ ④ \end{matrix}
\begin{bmatrix}
\frac{1}{C_1 S} + L_1 S + R_3 + R_1 & +\frac{R_1 g_m}{C_2 S} - L_1 S & -R_3 & \frac{-1}{C_1 S} \\
-L_1 S & R_2 + \frac{1}{C_2 S} + L_2 S + L_1 S & -L_2 S & -R_2 - \frac{1}{C_2 S} \\
-R_3 & -L_2 S & L_2 S + R_3 & 0 \\
\frac{-1}{C_1 S} + \alpha & -R_2 - \frac{1}{C_2 S} & \cancel{0} - \alpha & R_4 + \frac{1}{C_2 S} + R_2 + \frac{1}{C_1 S}
\end{bmatrix}
\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix}
=
\begin{bmatrix}
\cancel{R_1 g_m V_{C_2}} \\
0 \\
-I_s \\
-\alpha i_x
\end{bmatrix}
\begin{matrix} 0 \\ \\ \\ 0 \end{matrix}
$$

$V_{C_2} = I_2 \times \frac{1}{C_2 S}$

$I_x = I_1 - I_3$

$I_x = I_1 + I_s$

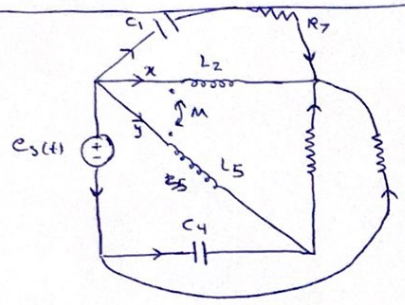
#6



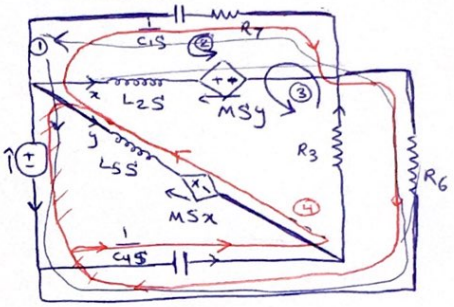
درخت → 3,4,5

$$\begin{bmatrix} \frac{1}{s}+1+3 & 1 & 3 \\ 1 & \frac{1}{2s}+3 & 2 \\ 3 & 2 & \frac{2+3}{2s} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} V_s \\ -V_s \\ 0 \end{bmatrix}$$

#7



$\Rightarrow$

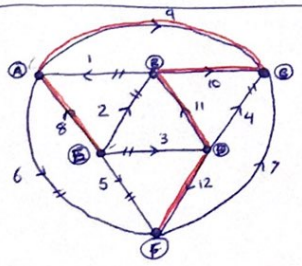


درخت → R_7, R_6, L_5

$$\begin{bmatrix} R_6+R_7+\frac{1}{C_1S} & R_7+\frac{1}{C_1S} & R_7+\frac{1}{C_1S} & -R_7-\frac{1}{C_1S} \\ R_7+\frac{1}{C_1S} & R_7+\frac{1}{C_1S}+L_2S & \frac{1}{C_1S}+R_7+MS & \frac{-1}{C_1S}-R_7-MS \\ R_7+\frac{1}{C_1S} & R_7+\frac{1}{C_1S}+MS & R_3+R_7+\frac{1}{C_1S}+L_5S & -L_5S-R_7-\frac{1}{C_1S} \\ -R_7-\frac{1}{C_1S} & \frac{-1}{C_1S}-R_7-MS & -L_5S-R_7-\frac{1}{C_1S} & L_5S+R_7+\frac{1}{C_1S}+R_6+\frac{1}{C_4S} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} -E_s \\ -MSy \\ -MSx \\ MSx \end{bmatrix} \begin{matrix} \\ 0 \\ 0 \\ 0 \end{matrix}$$

$x = I_2 \;,\; y = I_3 - I_4$

#8



تعداد شاخه‌های درختی : $6-1=5 \rightarrow (8,9,10,11,12)$

تعداد لینک : $12-5=7 \rightarrow (1,2,3,4,5,6,7)$

① : $(\underline{1},9,10)$

② : $(8,9,10,\underline{2})$

③ : $(9,10,11,\underline{3},8)$

④ : $(10,\underline{4},11)$

⑤ : $(8,9,10,11,12,\underline{5})$

⑥ : $(12,11,10,9,\underline{6})$

⑦ : $(12,11,10,\underline{7})$

$$B = \begin{array}{c} \\ ① \\ ② \\ ③ \\ ④ \\ ⑤ \\ ⑥ \\ ⑦ \end{array} \begin{array}{c} \begin{array}{ccccccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & -1 & -1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & -1 & -1 & 1 & 1 & -1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -1 & 1 & 1 & -1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -1 & -1 & 1 \end{bmatrix} \end{array}$$