Step	Algorithm:
1a	
4	where
2	
3	while do
2,3	$\wedge$
5a	where
6	
8	
5b	
7	
2	
	endwhile
2,3	$\wedge \neg (\quad)$
1b	

<table>
<tr><th>Step</th><th>Algorithm: $[C] := \text{SYMM\_LU\_UNB\_VAR4}(A, B, C)$</th></tr>
<tr><td>1a</td><td>$C = \widehat{C}$</td></tr>
<tr><td>4</td><td>$A \rightarrow \left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right)$, $B \rightarrow \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right)$, $C \rightarrow \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right)$
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<tr><td>3</td><td>while $m(A_{TL}) < m(A)$ do</td></tr>
<tr><td>2,3</td><td>$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge m(A_{TL}) < m(A)$</td></tr>
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<tr><td>5b</td><td>$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$</td></tr>
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<tr><td>1b</td><td>$[C] = \text{symm\_lu}(A, B, \widehat{C})$</td></tr>
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Algorithm: $[C] := \textsc{symm\_lu\_unb\_var4}(A, B, C)$

$$A \rightarrow \left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right), B \rightarrow \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right), C \rightarrow \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right)$$

where A_{TL} is 0×0, B_T has 0 rows, C_T has 0 rows

while $m(A_{TL}) < m(A)$ **do**

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right), \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row

$C_0 := a_{01} b_1^T + C_0$

$c_1^T := a_{01}^T B_0 + \alpha_{11} b_1^T + c_1^T$

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right), \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

endwhile

Step	Algorithm: $[C] := \text{SYMM\_LU\_UNB\_VAR4}(A, B, C)$
1a	$C = \widehat{C}$
4	where
2	
3	while do
2,3	$\wedge$
5a	where
6	
8	
5b	
7	
2	
	endwhile
2,3	$\wedge \neg($ $)$
1b	$[C] = \text{symm\_lu}(A, B, \widehat{C})$

Step	Algorithm: $[C] := \text{SYMM\_LU\_UNB\_VAR4}(A, B, C)$
1a	$C = \widehat{C}$
4	where
2	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right)$
3	while do
2,3	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right) \wedge$
5a	where
6	
8	
5b	
7	
2	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right)$
	endwhile
2	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right) \wedge \neg(\quad)$
1b	$[C] = \text{symm\_lu}(A, B, \widehat{C})$

Step	Algorithm: $[C] := \text{SYMM\_LU\_UNB\_VAR4}(A, B, C)$
1a	$C = \widehat{C}$
4	where
2	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right)$
3	while $m(A_{TL}) < m(A)$ do
2,3	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right) \wedge m(A_{TL}) < m(A)$
5a	where
6	
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2	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right)$
	endwhile
2,3	$\left(\frac{C_T}{C_B}\right) = \left(\frac{\widehat{C}_T}{\widehat{C}_B}\right) \wedge \neg(m(A_{TL}) < m(A))$
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Step	Algorithm: $[C] := \text{SYMM\_LU\_UNB\_VAR4}(A, B, C)$
1a	$C = \widehat{C}$
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
3	while $m(A_{TL}) < m(A)$ do
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge m(A_{TL}) < m(A)$
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6	
8	
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
	endwhile
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge \neg(m(A_{TL}) < m(A))$
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1a	$C = \widehat{C}$
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
3	while $m(A_{TL}) < m(A)$ do
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5a	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$ where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row
6	
8	
5b	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$
7	
2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
	endwhile
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge \neg(m(A_{TL}) < m(A))$
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
3	while $m(A_{TL}) < m(A)$ do
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge m(A_{TL}) < m(A)$
5a	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$ where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row
6	$\left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right) = \left(\begin{array}{c} A_{00}B_0 + \widehat{C}_0 \\ \hline \widehat{c}_1^T \\ \hline \widehat{C}_2 \end{array}\right)$
8	
5b	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$
7	
2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
	endwhile
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge \neg(m(A_{TL}) < m(A))$
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
3	while $m(A_{TL}) < m(A)$ do
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge m(A_{TL}) < m(A)$
5a	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$ where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row
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8	
5b	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$
7	$\left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right) = \left(\begin{array}{c} A_{00}B_0 + a_{01}b_1^T + \widehat{C}_0 \\ \hline a_{01}^T B_0 + \alpha_{11} b_1^T + \widehat{c}_1^T \\ \hline \widehat{C}_2 \end{array}\right)$
2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
	endwhile
2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge \neg(m(A_{TL}) < m(A))$
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2	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right)$
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2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge m(A_{TL}) < m(A)$
5a	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$ where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row
6	$\left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right) = \left(\begin{array}{c} A_{00}B_0 + \widehat{C}_0 \\ \hline \widehat{c}_1^T \\ \hline \widehat{C}_2 \end{array}\right)$
8	$C_0 := a_{01}b_1^T + C_0$ $c_1^T := a_{01}^T B_0 + \alpha_{11}b_1^T + c_1^T$
5b	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$
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	endwhile
2,3	$\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) = \left(\begin{array}{c} \widehat{C}_T \\ \hline \widehat{C}_B \end{array}\right) \wedge \neg(m(A_{TL}) < m(A))$
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	$A \rightarrow \left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right)$, $B \rightarrow \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right)$, $C \rightarrow \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right)$ where A_{TL} is 0×0, B_T has 0 rows, C_T has 0 rows
	while $m(A_{TL}) < m(A)$ do
	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$ where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row
	$C_0 := a_{01} b_1^T + C_0$ $c_1^T := a_{01}^T B_0 + \alpha_{11} b_1^T + c_1^T$
	$\left(\begin{array}{c\|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c\|c\|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right)$, $\left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right)$, $\left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$
	endwhile

Algorithm: $[C] := \textsc{symm\_lu\_unb\_var4}(A, B, C)$

$$A \rightarrow \left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right), \; B \rightarrow \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right), \; C \rightarrow \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right)$$

where A_{TL} is 0×0, B_T has 0 rows, C_T has 0 rows

while $m(A_{TL}) < m(A)$ **do**

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \rightarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right), \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \rightarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \rightarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

where α_{11} is 1×1, b_1 has 1 row, c_1 has 1 row

$C_0 := a_{01} b_1^T + C_0$

$c_1^T := a_{01}^T B_0 + \alpha_{11} b_1^T + c_1^T$

$$\left(\begin{array}{c|c} A_{TL} & A_{TR} \\ \hline A_{BL} & A_{BR} \end{array}\right) \leftarrow \left(\begin{array}{c|c|c} A_{00} & a_{01} & A_{02} \\ \hline 0 & \alpha_{11} & a_{12}^T \\ \hline 0 & 0 & A_{22} \end{array}\right), \left(\begin{array}{c} B_T \\ \hline B_B \end{array}\right) \leftarrow \left(\begin{array}{c} B_0 \\ \hline b_1^T \\ \hline B_2 \end{array}\right), \left(\begin{array}{c} C_T \\ \hline C_B \end{array}\right) \leftarrow \left(\begin{array}{c} C_0 \\ \hline c_1^T \\ \hline C_2 \end{array}\right)$$

endwhile