

$$L=4$$

$$(X=0, C=1) \\ (i_2, i_1) \rightarrow$$

$$P_{jk} = e^{\delta_{j0} K_0} F_{111j}$$

$$\boxed{1}$$

$$(i_4, i_3)$$

↓

	U	Λ	00	01	10	11
00	1	1	M_{00K}	M_{10K}	M_{01K}	M_{11K}
01	1					
10	1					
11	1					

V

$$= F_{i_4 i_3 i_2 i_1}$$

$$M_{i_1 K} = M_{0K} \text{ or } M_{1K} \\ i_1=0 \quad i_1=1$$

$$t=\Delta t \quad F_{111j} = M_{0K} \text{ or } M_{1K} \quad \left(P_{jk} = e^{\delta_{j0} K_0} F_{111j} \right) \\ j=0 \quad j=1$$

$$Q_{ie}^{(1)} = M_{ie} e^{\delta_{e0} K_0} e^{\delta_{e0} \delta_{i0} 2K_1}$$

$$Q_{ie}^{(2)} = e^{\delta_{e0} \delta_{i0} 2K_2}$$

$$Q_{ie}^{(3)} = e^{\delta_{e0} \delta_{i0} 2K_3}$$

$$Q_{ie}^{(4)} = e^{\delta_{e0} \delta_{i0} 2K_4}$$

$$\tilde{U}_{nK}^{(0)} = Q_{i_4 0}^{(3)} Q_{i_3 0}^{(2)} U_{nK}$$

$$\tilde{U}_{nK}^{(1)} = Q_{i_4 1}^{(3)} Q_{i_3 1}^{(2)} U_{nK} = U_{nK}$$

$$\tilde{U}_{nK}^{(2)} = Q_{i_4 0}^{(3)} Q_{i_3 0}^{(2)} U_{nK} = U_{nK} \quad Q_{i_4 0}^{(3)} = e^{\delta_{i_4 0} 2K_3} \quad Q_{i_3 0}^{(2)} = e^{\delta_{i_3 0} 2K_2}$$

$$V_{km} \rightarrow V_{km'}^{(0)}, \quad V_{km'}^{(1)}$$

$$i_1 = 0, \quad i_1 = 1$$

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$$\tilde{V}_{km'}^{(0,p)} = Q_{p0}^{(4)} Q_{i20}^{(1)} V_{km'}^{(0)}$$

$$\tilde{V}_{km'}^{(1,p)} = Q_{p1}^{(4)} Q_{i21}^{(1)} V_{km'}^{(1)} = V_{km'}^{(1)} M_{i21}$$

$$Q_{i0}^{(4)} = e^{s_{i0} 2K_4} \quad Q_{i0}^{(1)} = e^{s_{i0} 2K_1} M_{i0} e^{K_0}$$

$$Q_{i1}^{(1)} = M_{i1}$$

(i_4, i_3)

↓

	$\tilde{U}_{nk}^{(0)}$	$\tilde{U}_{nk}^{(1)}$
00		1
01		1
10		1
11		1

↓

1

1

p=0

p=1

$\tilde{V}^{(0,0)}$	$\tilde{V}^{(0,1)}$
$\tilde{V}^{(1,0)}$	$\tilde{V}^{(1,1)}$

00	$Q_{00}^{(3)}$	$Q_{00}^{(2)}$	=	e^{2K_3}	e^{2K_2}
01	$Q_{00}^{(3)}$	$Q_{10}^{(2)}$		e^{2K_3}	
10	$Q_{10}^{(3)}$	$Q_{00}^{(2)}$		e^{2K_2}	
11	$Q_{10}^{(3)}$	$Q_{10}^{(2)}$		1	

$$m = (i_2, i_1) \rightarrow$$

$$V \begin{array}{|c|c|c|c|} \hline 00 & 01 & 10 & 11 \\ \hline M_{0K} & M_{1K} & M_{0K} & M_{1K} \\ \hline \end{array}$$

$$V^{(0)} \begin{array}{|c|c|} \hline 00 & 10 \\ \hline M_{0K} & M_{0K} \\ \hline \end{array} \quad i_1 = 0$$

$$V^{(1)} \begin{array}{|c|c|} \hline 01 & 11 \\ \hline M_{1K} & M_{1K} \\ \hline \end{array} \quad i_1 = 1$$

$$p = 0$$

$$p = 1$$

$$\tilde{V}^{(0,0)} \begin{array}{|c|c|c|c|} \hline \cancel{00} & \cancel{10} & & \\ \hline Q_{00}^{(4)} Q_{00}^{(1)} M_{0K} & Q_{00}^{(4)} Q_{10}^{(1)} M_{0K} & & \\ \hline \end{array}$$

$$\tilde{V}^{(0,1)} \begin{array}{|c|c|} \hline \cancel{00} & \cancel{10} \\ \hline & \\ \hline \end{array}$$

$$\tilde{V}^{(1,0)} \begin{array}{|c|c|c|c|} \hline \cancel{00} & \cancel{10} & & \\ \hline Q_{00}^{(4)} Q_{00}^{(1)} M_{1K} & Q_{00}^{(4)} Q_{10}^{(1)} M_{1K} & & \\ \hline \end{array}$$

$$\tilde{V}^{(1,1)} \begin{array}{|c|c|} \hline \cancel{00} & \cancel{10} \\ \hline & \\ \hline \end{array}$$

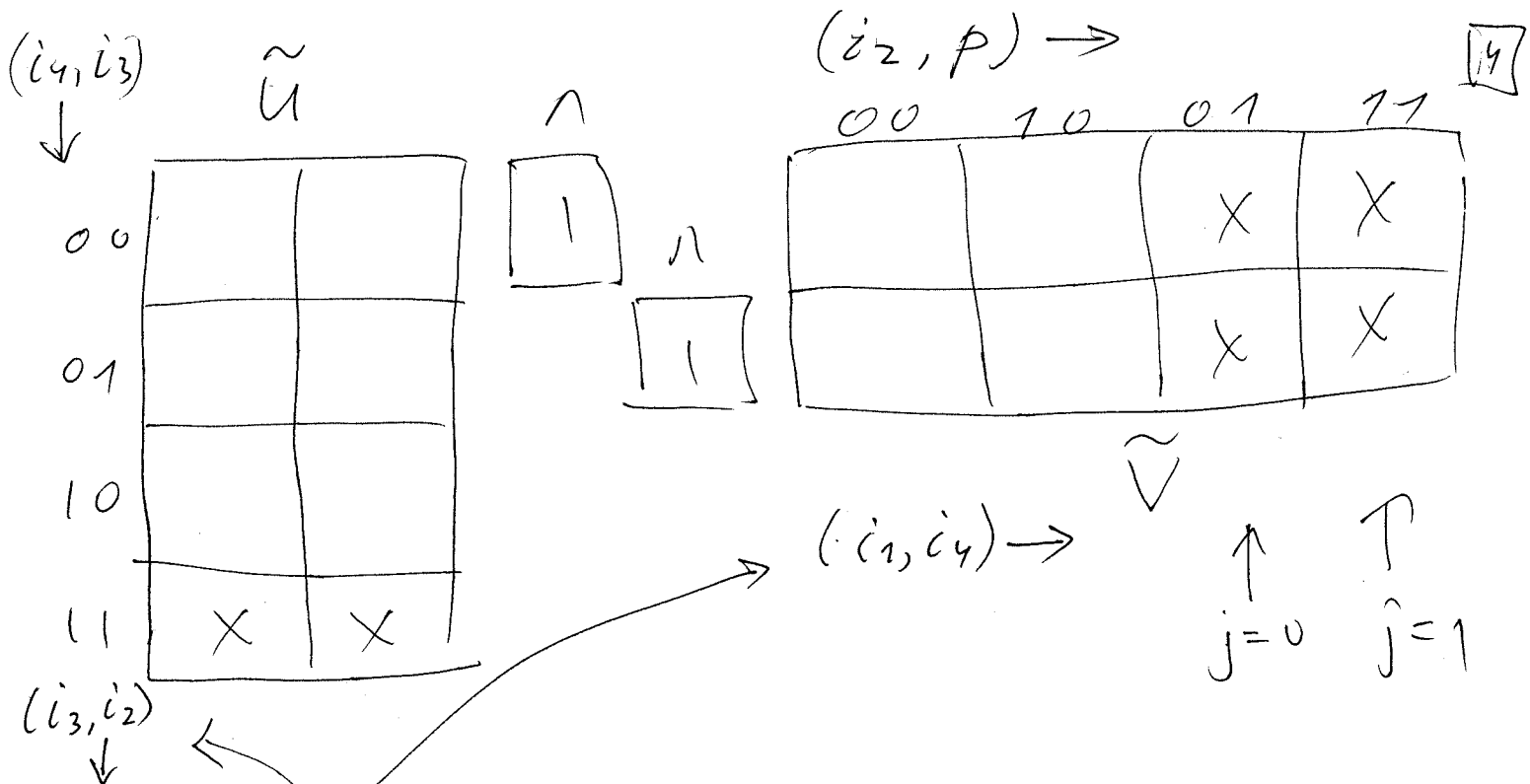
$$\tilde{V}^{(0,1)} \begin{array}{|c|c|c|c|} \hline 00 & 10 & & \\ \hline Q_{10}^{(4)} Q_{00}^{(1)} M_{0K} & Q_{10}^{(4)} Q_{10}^{(1)} M_{0K} & & \\ \hline \end{array}$$

$$\tilde{V}^{(1,1)} \begin{array}{|c|c|c|c|} \hline 01 & 11 & & \\ \hline Q_{11}^{(4)} Q_{01}^{(1)} M_{1K} & Q_{11}^{(4)} Q_{11}^{(1)} M_{1K} & & \\ \hline \end{array}$$

replace i_1 with p

$$(i_2, p) \rightarrow$$

$$\tilde{V} \begin{array}{|c|c|c|c|} \hline 00 & 10 & 01 & 11 \\ \hline \cancel{Q_{00}^{(4)} Q_{00}^{(1)} M_{0K}} & \cancel{Q_{10}^{(4)} M_{0K}} & & \\ \hline 00 & 10 & 01 & 11 \\ \hline M_{0K} & & & \\ \hline \end{array}$$



Change $i_4 i_3 i_2 p \rightarrow i_3 i_2 i_1 i_4$

$$t = 2\Delta t$$

$$F_{\underbrace{111}_{i_4 i_2} j_{i_1}}$$

$$F_{1110} = 1 \cdot 1 \cdot Q_{00}^{(1)} M_{0K} + 1 \cdot 1 \cdot Q_{01}^{(1)} M_{1K}$$

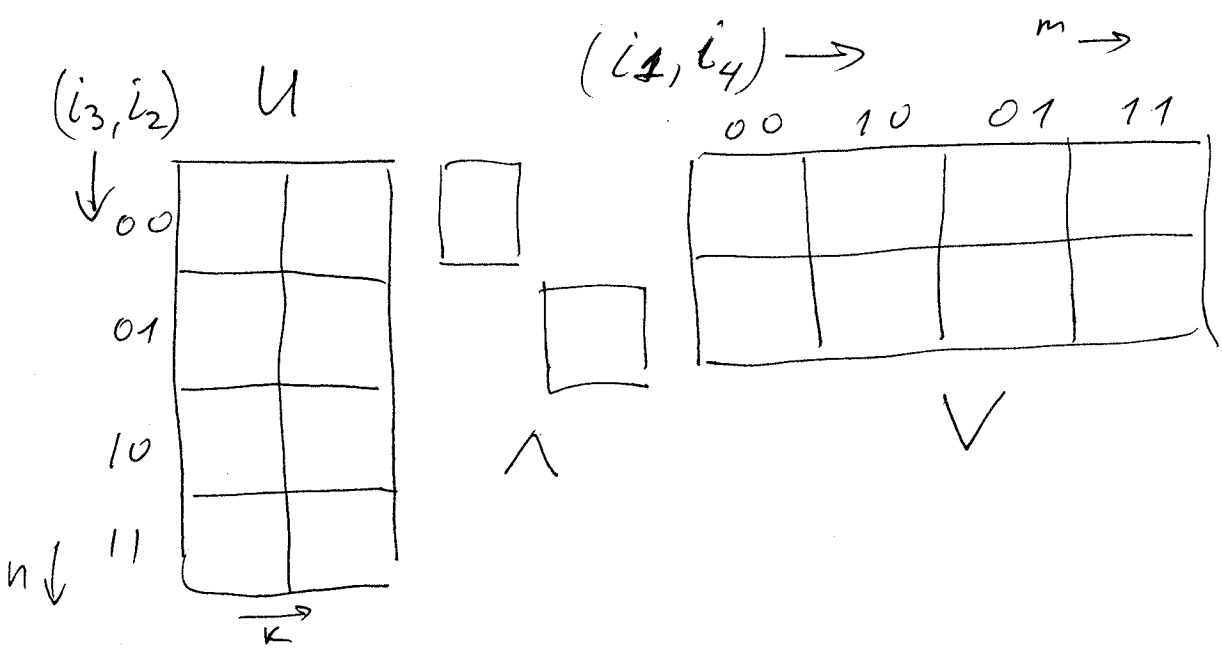
$$F_{1111} = 1 \cdot 1 \cdot Q_{10}^{(1)} M_{0K} + 1 \cdot 1 \cdot Q_{11}^{(1)} M_{1K}$$

$$Q_{00}^{(1)} = e^{K_0 + 2K_1} M_{00}$$

$$Q_{01}^{(1)} = M_{01}$$

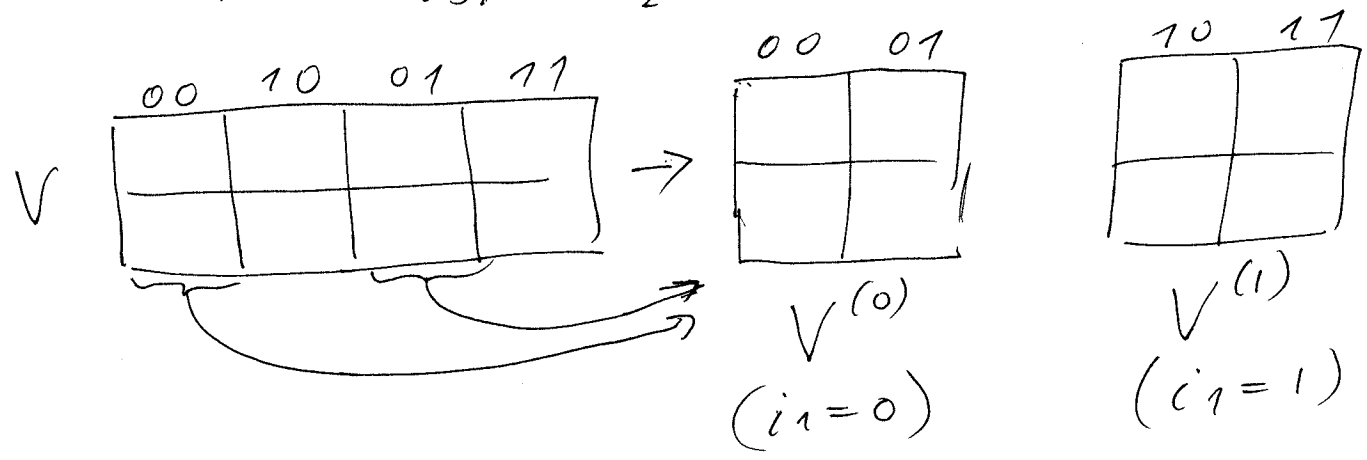
$$Q_{10}^{(1)} = e^{K_0} M_{10}$$

$$Q_{11}^{(1)} = M_{11}$$



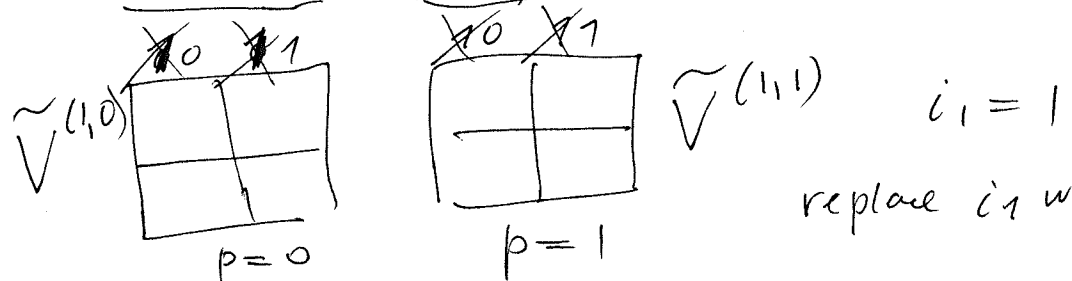
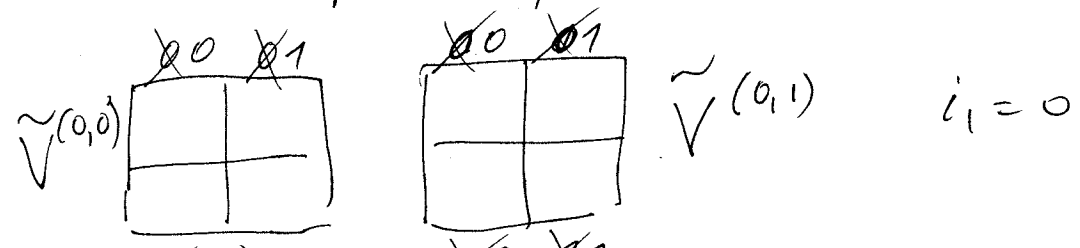
$$\tilde{U}_{nk}^{(0)} = Q_{i_{30}}^{(2)} Q_{i_{20}}^{(1)} U_{nk}$$

$$\tilde{U}_{nk}^{(1)} = Q_{i_{31}}^{(2)} Q_{i_{21}}^{(1)} U_{nk}$$



$$\tilde{V}_{km'}^{(0,p)} = Q_{p0}^{(4)} Q_{i_{40}}^{(3)} V_{km'}^{(0)}$$

$$\tilde{V}_{km'}^{(1,p)} = Q_{p1}^{(4)} Q_{i_{41}}^{(3)} V_{km'}^{(1)}$$



replace i_1 with p

$(p, i_4) \rightarrow$

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$\sim V$

	00	01	10	11

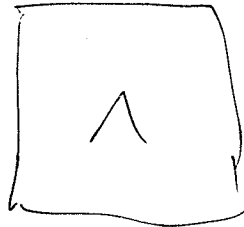
change $i_4 i_3 i_2 p \rightarrow i_3 i_2 i_1 i_4$

(i_2, i_1)

\downarrow

00	
01	
10	x x x x
11	0 0 0 0

U



$(i_4, i_3) \rightarrow$

	00	01	10	11
				x
				x
				x
				x

V

$t = 3\Delta t$

$F_{\underbrace{111}_{i_4-i_2} \underbrace{j}_{i_1}}$

Here if $j = 0$ ~~multiply~~ ^{take} x x x x from U
 if $j = 1$ ~~multiply~~ ^{take} 0 0 0 0 from U