Условие

12	6	29	19	21	13
14	3	30	10	10	27
15	27	28	11	24	16
1	23	25	15	13	14
14	14	14	14	14	Closed

Северозападный угол

12	6	29	19	21	13
14	3	30	10	10	27
15	27	28	11	24	16
1	23	25	15	13	14
14	14	14	14	14	

13	0	0	0	0	13
					27
					16
					14
14-13=1	14	14	14	14	

13	0	0	0	0	13
1					27-1=26
0					16
0					14
1	14	14	14	14	

13	0	0	0	0	13
1	14				26-14=12
0	0				16
0	0				14
1	14	14	14	14	

13	0	0	0	0	13
1	14	12	0	0	12
0	0				16
0	0				14
1	14	14-12=2	14	14	

13	0	0	0	0	13
1	14	12	0	0	12
0	0	2			16-2=14
0	0	0			14
1	14	2	14	14	

13	0	0	0	0	13
1	14	12	0	0	12
0	0	2	14		14-14=0
0	0	0	0		14
1	14	2	14	14	

13	0	0	0	0	13
1	14	12	0	0	12
0	0	2	14	0	0
0	0	0	0		14
1	14	2	14	14	

13	0	0	0	0	13
1	14	12	0	0	12
0	0	2	14	0	0
0	0	0	0	14	14-14=0
1	14	2	14	14	

Северозападный угол

$$X^{(0)}=\begin{pmatrix} 13 & 0 & 0 & 0 & 0 \\ 1 & 14 & 12 & 0 & 0 \\ 0 & 0 & 1 & 14 & 0 \\ 0 & 0 & 0 & 0 & 14 \end{pmatrix} \qquad f\left(X^{(0)}\right)=$$ 964

Минимальный элемент

12	6	29	19	21	13
14	3	30	10	10	27
15	27	28	11	24	16
1	23	25	15	13	14
14	14	14	14	14	

~~12 (0)~~	6	29	19	21	13
~~14 (0)~~	3	30	10	10	27
~~15 (0)~~	27	28	11	24	16
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14	14	

~~12 (0)~~	~~6 (0)~~	29	19	21	13
~~14 (0)~~	3 (14)	30	10	10	27;13
~~15 (0)~~	~~27 (0)~~	28	11	24	16
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14	14	

~~12 (0)~~	~~6 (0)~~	29	19	21	13
~~14 (0)~~	3 (14)	~~30 (0)~~	10 (13)	~~10 (0)~~	27;13
~~15 (0)~~	~~27 (0)~~	28	11	24	16
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14; 1	14	

~~12 (0)~~	~~6 (0)~~	29	~~19 (0)~~	21	13
~~14 (0)~~	3 (14)	~~30 (0)~~	10 (13)	~~10 (0)~~	27;13
~~15 (0)~~	~~27 (0)~~	28	11 (1)	24	16;15
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14; 1	14	

~~12 (0)~~	~~6 (0)~~	~~29 (0)~~	~~19 (0)~~	21 (13)	13
~~14 (0)~~	3 (14)	~~30 (0)~~	10 (13)	~~10 (0)~~	27;13
~~15 (0)~~	~~27 (0)~~	28	11 (1)	24	16;15
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14; 1	14;1	

~~12 (0)~~	~~6 (0)~~	~~29 (0)~~	~~19 (0)~~	21 (13)	13
~~14 (0)~~	3 (14)	~~30 (0)~~	10 (13)	~~10 (0)~~	27;13
~~15 (0)~~	~~27 (0)~~	28	11 (1)	24 (1)	16;15;14
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14; 1	14;1	

~~12 (0)~~	~~6 (0)~~	~~29 (0)~~	~~19 (0)~~	21 (13)	13
~~14 (0)~~	3 (14)	~~30 (0)~~	10 (13)	~~10 (0)~~	27;13
~~15 (0)~~	~~27 (0)~~	28 (14)	11 (1)	24 (1)	16;15;14
1 (14)	~~23 (0)~~	~~25 (0)~~	~~15 (0)~~	~~13 (0)~~	14;0
14	14	14	14; 1	14;1	

$$X^{(0)}=\begin{pmatrix} 0 & 0 & 0 & 0 & 13 \\ 0 & 14 & 0 & 13 & 0 \\ 0 & 0 & 14 & 1 & 1 \\ 14 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad f\left(X^{(0)}\right)= \boxed{886}$$

$$X^{(0)}=\begin{pmatrix} 0 & 0 & 0 & 0 & 13 \\ 0 & 14 & 0 & 13 & 0 \\ 0 & 0 & 14 & 1 & 1 \\ 14 & 0 & 0 & 0 & 0 \end{pmatrix}$$ Минимальный элемент $f(X^{(0)})=$

12	6	29	19	21	13	
14	3	30	10	10	27	
15	27	28	11	24	16	
1	23	25	15	13	14	
14	14	14	14	14		

~~12~~	6	29	19	21	13	6
~~14~~	3	30	10	10	27	7
~~15~~	27	28	11	24	16	4
1 (14)	23	25	15	13	14	12
14;0	14	14	14	14		
11	3	3	1	3	max=	12
					min=	1

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	13
~~14~~	3	30	10	10	27	7
~~15~~	27	28	11	24	16	13
1 (14)	23	25	15	13	14	2
14;0	14;1	14	14	14		
	3	3	1	3	max=	13
					min=	6

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	
~~14~~	3 (1)	30	10	10	27;26	7
~~15~~	~~27~~	28	11	24	16	13
1 (14)	~~23~~	25	15	13	14	2
14;0	14;1	14	14	14		
	20	5	1	3	max=	20
					min=	3

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	
~~14~~	3 (1)	30	~~10~~	10	27;26	0
~~15~~	~~27~~	28	11 (14)	24	16;2	13
1 (14)	~~23~~	25	~~15~~	13	14	2
14;0	14;1	14	14	14		
		5	1	3	max=	13
					min=	11

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	
~~14~~	3 (1)	30	~~10~~	10 (14)	27;26;12	20
~~15~~	~~27~~	28	11 (14)	~~24~~	16;2	4
1 (14)	~~23~~	25	~~15~~	~~13~~	14	12
14;0	14;1	14	14	14		
		5		3	max=	20
					min=	10

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	
~~14~~	3 (1)	30 (12)	~~10~~	10 (14)	27;26;12	30
~~15~~	~~27~~	28	11 (14)	~~24~~	16;2	28
1 (14)	~~23~~	25	~~15~~	~~13~~	14	25
14;0	14;1	14;2	14	14		
		5			max=	30
					min=	30

Фогеля

~~12~~	6 (13)	~~29~~	~~19~~	~~21~~	13	
~~14~~	3 (1)	30 (12)	~~10~~	10 (14)	27;26;12	
~~15~~	~~27~~	28 (2)	11 (14)	~~24~~	16;2;0	28
1 (14)	~~23~~	~~25~~	~~15~~	~~13~~	14	25
14;0	14;1	14;2	14	14		
		3			max=	28
					min=	28

$$X^{(0)}=\begin{pmatrix} 0 & 13 & 0 & 0 & 0 \\ 0 & 1 & 12 & 0 & 14 \\ 0 & 0 & 2 & 14 & 0 \\ 14 & 0 & 0 & 0 & 0 \end{pmatrix} \quad f\left(X^{(0)}\right)= 805$$

Метод потенциалов

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0	29 0	19 0	21 ***13***	13
u_2	14 0	3 ***14***	30 0	10 ***13***	10 0	27
u_3	15 0	27 0	28 ***14***	11 ***1***	24 ***1***	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0	29 0	19 0	21 ***13***	13
u_2	14 0	3 ***14***	30 0	10 ***13*** [-]	10 0 [+]	27
u_3	15 0	27 0	28 ***14***	11 ***1*** [+]	24 ***1*** [-]	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0	29 0	19 0	21 ***13***	13
u_2	14 0	3 ***14***	30 0	10 ***12***	10 ***1***	27
u_3	15 0	27 0	28 ***14***	11 ***2***	24 0	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0	29 ***0*** [+]	19 0	21 ***13*** [-]	13
u_2	14 0	3 ***14***	30 0	10 ***12*** [-]	10 ***1*** [+]	27
u_3	15 0	27 0	28 ***14*** [-]	11 ***2*** [+]	24 0	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0	29 ***12***	19 0	21 ***1***	13
u_2	14 0	3 ***14***	30 0	10 0	10 ***13***	27

Метод потенциалов

u_3	15 0	27 0	28 ***2***	11 ***14***	24 0	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 0 [+]	29 ***12***	19 0	21 ***1*** [-]	13
u_2	14 0	3 ***14*** [-]	30 0	10 0	10 ***13*** [+]	27
u_3	15 0	27 0	28 ***2***	11 ***14***	24 0	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

	v_1	v_2	v_3	v_4	v_5	a_i
u_1	12 ***0***	6 ***1***	29 ***12***	19 0	21 0	13
u_2	14 0	3 ***13***	30 0	10 0	10 ***14***	27
u_3	15 0	27 0	28 ***2***	11 ***14***	24 0	16
u_4	1 ***14***	23 0	25 0	15 0	13 0	14
b_j	14	14	14	14	14	

$$X^* = \begin{pmatrix} 0 & 1 & 12 & 0 & 0 \\ 0 & 13 & 0 & 0 & 14 \\ 0 & 0 & 2 & 14 & 0 \\ 14 & 0 & 0 & 0 & 0 \end{pmatrix} \quad f(X^*) = 757$$

$v_1-u_1=12,$ $u_1=0,$ $\Delta_{12}=v_2-u_1-c_{12}=1-0-6=-5,$
$v_5-u_1=21,$ $u_2=-2,$ $\Delta_{13}=v_3-u_1-c_{13}=25-0-29=-4,$
$v_2-u_2=3,$ $u_3=-3,$ $\Delta_{14}=v_4-u_1-c_{14}=8-0-19=-11,$
$v_4-u_2=10,$ $u_4=11,$ $\Delta_{21}=v_1-u_2-c_{21}=12+2-14=0,$
$v_3-u_3=28,$ $v_1=12,$ $\Delta_{23}=v_3-u_2-c_{23}=25+2-30=-3,$
$v_4-u_3=11,$ $v_2=1,$ $\Delta_{25}=v_5-u_2-c_{25}=21+2-10=13>0,\ (max)$
$v_5-u_3=24,$ $v_3=25,$ $\Delta_{31}=v_1-u_3-c_{31}=12+3-15=0,$
$v_1-u_4=1.$ $v_4=8,$ $\Delta_{32}=v_2-u_3-c_{32}=1+3-27=-23,$
$v_5=21,$ $\Delta_{42}=v_2-u_4-c_{42}=1-11-23=-33,$
$\Delta_{43}=v_3-u_4-c_{43}=25-11-25=-11,$
$\Delta_{44}=v_4-u_4-c_{44}=8-11-15=-17,$
$\Delta_{45}=v_5-u_4-c_{45}=21-11-13=-3$

$\theta=min\{1,\ 13\}=1=c_{35}$

$v_1-u_1=12,$ $u_1=0,$ $\Delta_{12}=v_2-u_1-c_{12}=14-0-6=8>0,$
$v_5-u_1=21,$ $u_2=11,$ $\Delta_{13}=v_3-u_1-c_{13}=38-0-29=9>0,\ (max)$
$v_2-u_2=3,$ $u_3=10,$ $\Delta_{14}=v_4-u_1-c_{14}=21-0-19=2>0,$
$v_4-u_2=10,$ $u_4=11,$ $\Delta_{21}=v_1-u_2-c_{21}=12-11-14=-13,$
$v_5-u_2=10,$ $v_1=12,$ $\Delta_{23}=v_3-u_2-c_{23}=38-11-30=-3,$
$v_3-u_3=28,$ $v_2=14,$ $\Delta_{31}=v_1-u_3-c_{31}=12-10-15=-13,$
$v_4-u_3=11,$ $v_3=38,$ $\Delta_{32}=v_2-u_3-c_{32}=14-10-27=-23,$
$v_1-u_4=1$ $v_4=21,$ $\Delta_{35}=v_5-u_3-c_{35}=21-10-24=-13,$
$v_5=21,$ $\Delta_{42}=v_2-u_4-c_{42}=14-11-23=-20,$
$\Delta_{43}=v_3-u_4-c_{43}=38-11-25=2>0,$
$\Delta_{44}=v_4-u_4-c_{44}=21-11-15=-5,$
$\Delta_{45}=v_5-u_4-c_{45}=21-11-13=-3$

$\theta=min\{12,\ 13,\ 14\}=12=c_{24}$

$v_1-u_1=12,$ $u_1=0,$ $\Delta_{12}=v_2-u_1-c_{12}=14-0-6=8>0,\ (max)$
$v_3-u_1=29,$ $u_2=11,$ $\Delta_{14}=v_4-u_1-c_{14}=12-0-19=-7,$
$v_5-u_1=21,$ $u_3=1,$ $\Delta_{21}=v_1-u_2-c_{21}=12-11-14=-13,$
$v_2-u_2=3,$ $u_4=11,$ $\Delta_{23}=v_3-u_2-c_{23}=29-11-30=-12,$
$v_5-u_2=10,$ $v_1=12,$ $\Delta_{24}=v_4-u_2-c_{24}=12-11-10=-9,$
$v_3-u_3=28,$ $v_2=14,$ $\Delta_{31}=v_1-u_3-c_{31}=12-1-15=-4,$
$v_4-u_3=11,$ $v_3=29,$ $\Delta_{32}=v_2-u_3-c_{32}=13-1-27=-15,$
$v_1-u_4=1$ $v_4=12,$ $\Delta_{35}=v_5-u_3-c_{35}=21-1-24=-4,$

$v_1-u_1=12,\quad u_1=0,\quad \Delta_{12}=v_2-u_1-c_{12}=14-0-6=8>0,\ (max)$

$v_3-u_1=29,\quad u_2=11,\quad \Delta_{14}=v_4-u_1-c_{14}=12-0-19=-7,$

$v_5-u_1=21,\quad u_3=1,\quad \Delta_{21}=v_1-u_2-c_{21}=12-11-14=-13,$

$v_2-u_2=3,\quad u_4=11,\quad \Delta_{23}=v_3-u_2-c_{23}=29-11-30=-12,$

$v_5-u_2=10,\quad v_1=12,\quad \Delta_{24}=v_4-u_2-c_{24}=12-11-10=-9,$

$v_3-u_3=28,\quad v_2=14,\quad \Delta_{31}=v_1-u_3-c_{31}=12-1-15=-4,$

$v_4-u_3=11,\quad v_3=29,\quad \Delta_{32}=v_2-u_3-c_{32}=13-1-27=-15,$

$v_1-u_4=1\quad v_4=12,\quad \Delta_{35}=v_5-u_3-c_{35}=21-1-24=-4,$

$v_5=21,\quad \Delta_{42}=v_2-u_4-c_{42}=14-11-23=-20,$

$\Delta_{43}=v_3-u_4-c_{43}=29-11-25=-8,$

$\Delta_{44}=v_4-u_4-c_{44}=12-11-15=-14,$

$\Delta_{45}=v_5-u_4-c_{45}=21-11-13=-3$

Метод потенциалов

$\theta=min\{1,\ 14\}=1=c_{15}$

$v_1-u_1=12,\quad u_1=0,\quad \Delta_{14}=v_4-u_1-c_{14}=12-0-19=-7,$

$v_2-u_1=6,\quad u_2=3,\quad \Delta_{15}=v_5-u_1-c_{15}=13-0-21=-8,$

$v_3-u_1=29,\quad u_3=1,\quad \Delta_{21}=v_1-u_2-c_{21}=12-3-14=-5,$

$v_2-u_2=3,\quad u_4=11,\quad \Delta_{23}=v_3-u_2-c_{23}=29-3-30=-4,$

$v_5-u_2=10,\quad v_1=12,\quad \Delta_{24}=v_4-u_2-c_{24}=12-3-10=-1,$

$v_3-u_3=28,\quad v_2=6,\quad \Delta_{31}=v_1-u_3-c_{31}=12-1-15=-4,$

$v_4-u_3=11,\quad v_3=29,\quad \Delta_{32}=v_2-u_3-c_{32}=6-1-27=-22,$

$v_1-u_4=1\quad v_4=12,\quad \Delta_{35}=v_5-u_3-c_{35}=13-1-25=-13,$

$v_5=13,\quad \Delta_{42}=v_2-u_4-c_{42}=6-11-23=-28,$

$\Delta_{43}=v_3-u_4-c_{43}=29-11-25=-7,$

$\Delta_{44}=v_4-u_4-c_{44}=12-11-15=-14,$

$\Delta_{45}=v_5-u_4-c_{45}=13-11-13=-11$