Симплекс метод

№1

$$f(x) = -x_1 + x_2 \to \min$$

$$\begin{cases} 2x_1 - 4x_2 - x_3 + x_4 = -3 \\ 4x_1 - 3x_2 - x_3 + x_4 + x_5 = 6 \\ x_1 + 4x_2 + x_3 + x_5 = 15 \end{cases} \Rightarrow \begin{cases} -2x_1 + 4x_2 + x_3 - x_4 - 3 = 0 \\ -4x_1 + 3x_2 + x_3 - x_4 - x_5 + 6 = 0 \\ -x_1 - 4x_2 - x_3 - x_5 + 15 = 0 \end{cases}$$

	$-x_1$	$-x_2$	$-x_3$	$-x_4$	$-x_5$	1
0	-2	4	*1*	-1	0	3
0	4	-3	-1	1	1	6
0	1	4	1	0	1	15
f	1	-1	0	0	0	0

	$-x_1$	$-x_2$	0	$-x_4$	$-x_5$	1
x_3	-2	4	1	-1	0	3
0	2	1	1	0	1	9
0	3	0	-1	1	1	12
f	1	-1	0	0	0	0

	$-x_1$	$-x_2$	$-x_4$	$-x_5$	1
x_3	-2	4	-1	0	3
0	2	*1*	0	1	9
0	3	0	1	1	12
f	1	-1	0	0	0

	$-x_1$	0	$-x_4$	$-x_5$	1
x_3	-10	-4	-1	-4	-33
x_2	2	1	0	1	9
0	3	0	1	1	12
f	3	1	0	1	9

	$-x_1$	$-x_4$	$-x_5$	1
x_3	-10	-1	-4	-33
x_2	2	0	1	9
0	3	1	*1*	12
f	3	0	1	9

	$-x_1$	$-x_4$	0	1
x_3	2	3	4	15
x_2	-1	-1	-1	-3
x_5	3	1	1	12
f	0	-1	-1	-3

	$-x_1$	$-x_4$	1
x_3	2	3	15
x_2	-1 *	-1	-3
x_5	3	1	12
f	0	-1	-3

	$-x_2$	$-x_4$	1
x_3	2	1	9
x_1	-1	1	3
x_5	3	-2	3
f	0	-1	-3

$$\overline{x}_{on} = [3, 0, 9, 0, 3]$$
$$\overline{x}_{onm} = [3, 0, 9, 0, 3]$$
$$f(\overline{x}_{on}) = f(\overline{x}_{onm}) = -3$$

№2

$$f(x) = x_1 + 2x_2 + x_3 - x_4 \to \min$$

$$\begin{cases} 10x_2 + x_3 + 2x_4 + 3x_5 = 25 \\ -x_1 + 5x_2 + x_3 + x_4 + x_5 = 10 \\ 2x_1 - x_2 + x_3 - 3x_4 = 6 \end{cases} \Rightarrow \begin{cases} -10x_2 - x_3 - 2x_4 - 3x_5 + 25 = 0 \\ x_1 - 5x_2 - x_3 - x_4 - x_5 + 10 = 0 \\ -2x_1 + x_2 - x_3 + 3x_4 + 6 = 0 \end{cases}$$

$$x_j \geq 0, \ j = 1, 2, 3, 4, 5$$

	$-x_1$	$-x_2$	$-x_3$	$-x_4$	$-x_5$	1
0	0	10	**_1_**	2	3	25
0	-1	5	1	1	1	10
0	2	-1	1	-3	0	6
f	-1	-2	-1	1	0	0

	$-x_1$	$-x_2$	0	$-x_4$	$-x_5$	1
x_3	0	10	1	2	3	25
0	-1	-5	-1	-1	-2	-15
0	2	-11	-1	-5	-3	-19
f	-1	8	1	3	3	25

	$-x_1$	$-x_2$	$-x_4$	$-x_5$	1
x_3	0	10	2	3	25
0	**_-1_**	-5	-1	-2	-15
0	2	-11	-5	-3	-19
f	-1	8	3	3	25

	0	$-x_2$	$-x_4$	$-x_5$	1
x_3	0	10	2	3	25
x_1	-1	5	1	2	15
0	2	-21	-7	-7	-49
f	-1	13	2	5	40

	$-x_2$	$-x_4$	$-x_5$	1
x_3	10	2	3	25
x_1	5	1	2	15
0	-21	-7	**_-7_**	-49
f	13	2	5	40

	$-x_2$	$-x_4$	0	1
x_3	1	-1	3/7	4
x_1	-1	-1	2/7	1
x_5	3	1	-1/7	7
f	-2	-3	5/7	5

	$-x_2$	$-x_4$	1
x_3	1	-1	4
x_1	-1	-1	1
x_5	3	1	7
f	-2	-3	5

$$\overline{x}_{on} = [1, 0, 4, 0, 7]$$
$$\overline{x}_{onm} = [1, 0, 4, 0, 7]$$
$$f(\overline{x}_{on}) = f(\overline{x}_{onm}) = 5$$

№9

$f(x) = x_1 - 2x_2 \to \min$

$$\begin{cases} -x_1 + x_2 \leq 0 \\ 2x_1 + x_2 \leq 3 \\ x_1 - x_2 \leq 1 \end{cases} \Rightarrow \begin{cases} x_1 - x_2 \geq 0 \\ -2x_1 - x_2 + 3 \geq 0 \\ -x_1 + x_2 + 1 \geq 0 \end{cases}$$

$x_1, x_2 \geq 0$

$x_1 - x_2 = x_3$

$-2x_1 - x_2 + 3 = x_4$

$-x_1 + x_2 + 1 = x_5$

	$-x_1$	$-x_2$	1
x_3	-1	*1*	0
x_4	2	1	3
x_5	1	-1	1
f	-1	-2	0

	$-x_1$	$-x_3$	1
x_2	-1	1	0
x_4	*3*	-1	3
x_5	0	1	1
f	1	-2	0

	$-x_4$	$-x_2$	1
x_2	1/3	2/3	1
x_1	1/3	-1/3	1
x_5	0	1	1
f	-1/3	-5/3	-1

$\overline{x}_{on} = [0, 0, 0, 3, 1]$

$\overline{x}_{onm} = [1, 1, 0, 0, 1]$

$f(\overline{x}_{on}) = 0$

$f(\overline{x}_{onm}) = -1$

№13

$$f(x) = x_1 + x_2 + x_3 \rightarrow \max$$

$$\begin{cases} -x_1 + x_2 + x_3 = 2 \\ -3x_1 + x_2 - x_3 = 0 \end{cases}, \quad x_i \geq 0, i = 1, 2, 3$$

$$\tilde{f}(x) = -x_1 - x_2 - x_3 \rightarrow \min$$

$$\begin{cases} x_1 - x_2 - x_3 + 2 = 0 \\ 3x_1 - x_2 + x_3 = 0 \end{cases}$$

	$-x_1$	$-x_2$	$-x_3$	1
0	-1	**_1_**	1	2
0	3	-1	1	0
f	1	1	1	0

	$-x_1$	0	$-x_3$	1
x_2	-1	-1	1	2
0	2	1	2	2
f	2	-1	0	-2

	$-x_1$	$-x_3$	1
x_2	-1	1	2
0	**_2_**	2	2
f	2	0	-2

	0	$-x_3$	1
x_2	-1/2	2	3
x_1	1/2	1	1
f	-1	-2	-4

$$\bar{x}_{on} = [1, 3, 0]$$
$$\bar{x}_{onm} = [1, 3, 0]$$
$$\tilde{f}(\bar{x}_{on}) = \tilde{f}(\bar{x}_{onm}) = -4$$
$$f(\bar{x}_{on}) = f(\bar{x}_{onm}) = 4$$