

№1

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

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

	x_1	x_2	x_3	x_4	x_5	1
0	2	-4	<u>-1</u>	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	1/2	-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	<u>-1</u>	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	-6	-4	1	-4	39
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	-6	1	-4	39
x_2	-2	0	-1	9
0	-3	-1	<u>-1</u>	12
f	-3	0	-1	9

	x_1	x_4	0	1
x_3	6	-5	4	-9
x_2	1	1	1	-3
x_5	-3	-1	-1	12
f	0	1	1	-3

	x_1	x_4	1
x_3	5	-5	-9
x_2	<u>1</u>	1	-3
x_5	-3	-1	12
f	0	1	-3

	x_2	x_4	1
x_3	6	-11	9
x_1	1	-1	3
x_5	-3	2	3
f	0	1	-3

$$\bar{x}_{on} = [3, 0, 9, 0, 3]$$

$$\bar{x}_{onm} = [3, 0, 9, 0, 3]$$

$$f(\bar{x}_{on}) = f(\bar{x}_{onm}) = -3$$

№2

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

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

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

	x_1	x_2	x_3	x_4	x_5	1
0	0	-10	<u>-1</u>	-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	<u>1</u>	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	-4	-5	40

	x_2	x_4	x_5	1
x_3	-10	-2	-3	25
x_1	-5	-1	-2	15
0	21	7	<u>7</u>	-49
f	-13	-4	-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	1	5/7	5

$$\bar{x}_{on} = [1, 0, 4, 0, 7]$$

$$\bar{x}_{onn} = [1, 0, 4, 0, 7]$$

$$f(\bar{x}_{on}) = f(\bar{x}_{onn}) = 5$$

№9

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

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

$$x_1, x_2 \geq 0$$

	x_1	x_2	1
x_3	1	<u>-1</u>	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	<u>-3</u>	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

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

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

№13

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

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

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

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

$$x_i \geq 0, i = 1, 2, 3$$

	x_1	x_2	x_3	1
0	1	<u>-1</u>	-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	<u>2</u>	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

	x_3	1
x_2	-2	3
x_1	-1	1
F	2	-4

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

$$\tilde{f}(\bar{x}_{on}) = \tilde{f}(\bar{x}_{onm}) = -4$$

$$f(\bar{x}_{on}) = f(\bar{x}_{onm}) = 4$$