

1.2.4

$$\begin{aligned} Z &= 15x_1 + 30x_2 \rightarrow \max; \\ Z - 15x_1 - 30x_2 &= 0 \\ \begin{cases} 3x_1 \leq 60 \\ x_2 \leq 50 \\ 2x_1 + x_2 \leq 80 \\ x_1, x_2 \geq 0 \end{cases} \end{aligned}$$

$$\begin{cases} 3x_1 + y_1 = 60; \\ x_2 + y_2 = 50; \\ 2x_1 + x_2 + y_3 = 80; \\ x_1, x_2, y_1, y_2, y_3 \geq 0. \end{cases}$$

Базиc	$x_1$	$x_2$	$y_1$	$y_2$	$y_3$	$b_i$	$b_i / \text{пор. ст.}$
$y_1$	3	0	1	0	0	60	60
$y_2$	0	1	0	1	0	50	50
$y_3$	2	1	0	0	1	80	80
	-15	-30	0	0	0	0	

$y_1$	3	0	1	0	0	60	20
$x_2$	0	1	0	1	0	50	-
$y_3$	2	0	0	-1	1	30	15
	-15	0	0	30	0	1500	

$y_1$	0	0	1	$\frac{2}{3}$	$-\frac{1}{3}$	40	
$x_2$	0	1	0	1	0	50	
$x_1$	2	0	0	-1	1	30	
	0	0	0	$12\frac{1}{2}$	$-\frac{15}{2}$	1225	

$$\begin{aligned} y_1 &= 60/3 = 20 \\ x_2 &= 50/1 = 50 \\ x_1 &= 30/2 = 15 \\ Z_{\max} &= 1225 \end{aligned}$$

$$\begin{aligned} Z_{\max}(15; 50; 60; 0; 0) &= 1225 \\ Z_{\max} &= 15 \cdot 15 + 30 \cdot 50 = 1225 \end{aligned}$$

1.8.  $Z = 300x_1 + 400x_2 \rightarrow \max;$

$Z - 300x_1 - 400x_2 = 0$

$$\begin{cases} 2x_1 + 3x_2 \leq 180; \\ 4x_1 + x_2 \leq 240; \\ 8x_1 + 27x_2 \leq 1350; \\ x_1, x_2 \geq 0 \end{cases} \quad \begin{cases} 2x_1 + 3x_2 + y_1 = 180; \\ 4x_1 + x_2 + y_2 = 240; \\ 8x_1 + 27x_2 + y_3 = 1350; \\ x_1, x_2, y_1, y_2, y_3 \geq 0. \end{cases}$$

bas	$x_1$	$x_2$	$y_1$	$y_2$	$y_3$	$b_i$	$b_i / \text{max } p_{\text{exp}}$
$y_1$	2	3	1	0	0	180	60
$y_2$	4	1	0	1	0	240	240
$y_3$	8	27	0	0	1	1350	50
$\Delta$	-300	-400	0	0	0	0	

$y_1$	$\frac{10}{3}$	0	1	0	$-\frac{1}{3}$	30	27
$y_3$	$\frac{100}{27}$	0	0	1	$-\frac{1}{27}$	190	60
$x_2$	8	27	0	0	1	1350	162,75
$\Delta$	$\frac{1000}{27}$	0	0	0	$+\frac{400}{27}$	240	

$x_1$	1	0	$\frac{5}{10}$	0	$-\frac{1}{10}$	37	-
$y_2$	0	0	$-\frac{1}{3}$	1	$\frac{1}{3}$	90	270
$x_2$	0	27	$-\frac{1}{5}$	0	$\frac{1}{15}$	42	630
$\Delta$	0	0	$-\frac{1}{10}$	0	$-\frac{10}{3}$	20000	

$x_1$	1	0	$-\frac{1}{10}$	$\frac{3}{10}$	0	54	
$y_3$	0	0	$-\frac{1}{10}$	3	1	270	
$x_2$	0	1	$\frac{4}{5}$	$-\frac{1}{5}$	0	24	
$\Delta$	0	0	130	10	0	25800	

$x_1 = 54; x_2 = 24;$

$Z(\max) = 300 \cdot 54 + 400 \cdot 24 = 25800$

1.10

$$Z = 100x_1 + 120x_2 + 70x_3 + 30x_4 \rightarrow \min$$

$$\begin{cases} 3x_1 + x_2 + 4x_3 + 4x_4 \leq 4600; & 3x_1 + x_2 \\ 2x_1 + x_2 + 2x_3 + 3x_4 \leq 3400; \end{cases}$$

$$\begin{aligned} \text{max. } & 3x_1 + x_2 + 4x_3 + 4x_4 + x_5 = 4600 \\ & 2x_1 + x_2 + 2x_3 + 3x_4 + x_6 = 3400. \end{aligned}$$

$$F(x) = Mx_5 + Nx_6 \rightarrow \min \quad (\text{метод искус. функции}).$$

$$x_5 = 4600 - 3x_1 - x_2 - 4x_3 - 4x_4;$$

$$x_6 = 3400 - 2x_1 - x_2 - 2x_3 - 3x_4;$$

$$F(x) = M(4600 - 3x_1 - x_2 - 4x_3 - 4x_4) + N(3400 - 2x_1 - x_2 - 2x_3 - 3x_4) \rightarrow \min.$$

$$F(x) = (-9M)x_1 + (-2M)x_2 + (-6M)x_3 + (-7M)x_4 + (8000M) \rightarrow \min.$$

$$\Delta F_0 = -5x_1 - 2x_2 - 6x_3 - 7x_4.$$

$$\begin{cases} x_0 = 8000 - 5x_1 - 2x_2 - 6x_3 - 7x_4 \\ x_5 = 4600 - 3x_1 - x_2 - 4x_3 - 4x_4 \\ x_6 = 3400 - 2x_1 - x_2 - 2x_3 - 3x_4 \end{cases} \quad \min = ? \quad (x_4) \Rightarrow \text{критерий}$$

↓

$$\min(4600:4; 3400:3) = 1133 \frac{1}{3}; \quad x_6 \Rightarrow x_4.$$

$$x_4 = 3400/3. \quad -\frac{2}{3}x_1 \quad -\frac{1}{3}x_2 \quad -\frac{2}{3}x_3 \quad -\frac{1}{3}x_6;$$

Поправки:

$$x_0 = 8000 - 5x_1 - 2x_2 - 6x_3 - 7(3400/3 - \frac{2}{3}x_1 - \frac{1}{3}x_2 - \frac{2}{3}x_3 - \frac{1}{3}x_6).$$

$$x_5 = 4600 - 3x_1 - x_2 - 4x_3 - 4(3400/3 - \frac{2}{3}x_1 - \frac{1}{3}x_2 - \frac{2}{3}x_3 - \frac{1}{3}x_6).$$

$$\begin{cases} x_0 = 200/3 - \frac{1}{3}x_1 + \frac{1}{3}x_2 - \frac{4}{3}x_3 + \frac{7}{3}x_6. \\ x_5 = 200/3 - \frac{1}{3}x_1 + \frac{1}{3}x_2 - \frac{4}{3}x_3 + \frac{4}{3}x_6. \\ x_4 = 3400/3 - \frac{2}{3}x_1 - \frac{1}{3}x_2 - \frac{2}{3}x_3 - \frac{1}{3}x_6. \end{cases}$$

$$\begin{cases} x_0 = 200/3 - \frac{1}{3}x_1 + \frac{1}{3}x_2 - \frac{4}{3}x_3 + \frac{7}{3}x_6. \\ x_5 = 200/3 - \frac{1}{3}x_1 + \frac{1}{3}x_2 - \frac{4}{3}x_3 + \frac{4}{3}x_6. \\ x_4 = 3400/3 - \frac{2}{3}x_1 - \frac{1}{3}x_2 - \frac{2}{3}x_3 - \frac{1}{3}x_6. \end{cases}$$

$$x = (1/3; -1/3; 4/3; 0; 0; 7/3) = 200/3.$$



$$\text{max } (1/3; 1/3; -4/3; 0; 0; 7/3) = 4/3;$$

$$x_6 = 200/3 - 1/3 x_1 + 1/3 x_2 - 4/3 x_3 + 7/3 x_6.$$

$$x_5 = 200/3 - 1/3 x_1 + 1/3 x_2 - 4/3 x_3 + 4/3 x_6.$$

$$x_4 = 3400/3 - 2/3 x_1 - 1/3 x_2 - 2/3 x_3 - 1/3 x_6.$$

Найдем  $x_3$ :

$$\min (6 \cdot 2/3; 1 \cdot 1/3; 1133/3; 2/3) = 50, \quad x_6 \Rightarrow x_3.$$

$$x_3 = 50 - 1/4 x_1 + 1/4 x_2 - 3/4 x_5 + x_6.$$

$$\begin{cases} x_6 = 200/3 - 1/3 x_1 + 1/3 x_2 - 1/3 (50 - 1/4 x_1 + 1/4 x_2 - 3/4 x_5 + x_6) \\ + 2/3 x_5. \end{cases}$$

$$x_6 = 1133/3 - 2/3 x_1 - 1/3 x_2 - 2/3 (50 - 1/4 x_1 + 1/4 x_2 - 3/4 x_5 + x_6) - 1/3 x_6.$$

$$x_6 = x_5 + x_6.$$

$$x_3 = 50 - 1/4 x_1 + 1/4 x_2 - 3/4 x_5 + x_6.$$

$$x_4 = 1100 - 1/2 x_1 - 1/2 x_2 + 1/2 x_5 + x_6.$$

$$x = (0, 0, 0, 0, -1, -1); x_6 = 0. \quad - \text{опт. план. так } x_6 \text{ не } \geq 0.$$

Значит!

$$x_3 = 50 - 1/4 x_1 - 1/4 x_2;$$

$$x_4 = 1100 - 1/2 x_1 - 1/2 x_2;$$

Итого получим:

$$F(x) = 100x_1 + 120x_2 + 70(50 - 1/4 x_1 - 1/4 x_2) + 30(1100 - 1/2 x_1 - 1/2 x_2) =$$

$$= 3500 + 135/2 x_1 + 245/2 x_2;$$

$$x_6 = 3500 + 135/2 x_1 + 245/2 x_2;$$

$$x_3 = 50 - 1/4 x_1 - 1/4 x_2;$$

$$x_4 = 1100 - 1/2 x_1 - 1/2 x_2.$$

$$F(x) = 100 \cdot 0 + 120 \cdot 0 + 70 \cdot 50 + 1100 \cdot 30 = 3500.$$