Итерация 3

$$\begin{cases} 5u_1 + 4u_2 = -105 \\ 5u_1 + u_2 = -75 \end{cases} \quad u = \begin{pmatrix} -13 \\ -10 \end{pmatrix}$$

$$\delta_2 = -125 - (2\ 1)\begin{pmatrix} -13 \\ -10 \end{pmatrix} = -89$$

$$\delta_4 = -75 - (1\ 1)\begin{pmatrix} -13 \\ -10 \end{pmatrix} = -52$$

$x_2 = 0$

$x_4 = 0$

$$\begin{cases} 5x_1 + 5x_3 = 2500 \\ 4x_1 + x_3 = 1500 \end{cases}$$

$x_1 = 333\frac{1}{3}$

$x_3 = 166\frac{2}{3}$

Условия оптимальности выполнены

$X^0 = (333\frac{1}{3}, 0, 166\frac{2}{3}, 0)$

$A_Б = (a_1, a_3)$

$$\begin{cases} 5x_3 + M = 2500 \\ x_3 + M + x_6 = 1500 \end{cases}$$

$x_3 = \frac{2500 - M}{5}$ $\quad x_6 = 1500 - M - \frac{2500-M}{5}$

$j_* = 6$

$$\begin{pmatrix} 5 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$$

$$p = \begin{pmatrix} \frac{1}{5} \\ -1 \end{pmatrix}$$

$p\delta_1 = -(5\ 4) \begin{pmatrix} \frac{1}{5} \\ -1 \end{pmatrix} = 3$

$p\delta_2 = -(2\ 1) \begin{pmatrix} \frac{1}{5} \\ -1 \end{pmatrix} = \frac{3}{5}$

$p\delta_4 = -(1\ 1) \begin{pmatrix} \frac{1}{5} \\ -1 \end{pmatrix} = \frac{4}{5}$

$\sigma_1 = 10$

$\sigma_3 = 30$

$\sigma_4 = 31\frac{1}{4}$

$j_0 = 3$

$J_Б = \{1, 3\}$

Удаляем x_6

$P^{\delta_1} = 5$

$P^{\delta_2} = 2$

$P^{\delta_3} = 5$

$P^{\delta_4} = 1$

$\sigma_1 = 21$

$\sigma_2 = 62.5$

$\sigma_3 = 15$

$\sigma_4 = 40$

$\sigma_0 = \sigma_3 = 15$

$J_5 = \{3.6\}$

Удалим x_5

Итерация 2

$$\begin{pmatrix} 5 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} = \begin{pmatrix} -15 \\ 0 \end{pmatrix} \quad u = \begin{pmatrix} -15 \\ 0 \end{pmatrix}$$

$$\delta_1 = -105 - (5\ 4) \begin{pmatrix} -15 \\ 0 \end{pmatrix} = -30$$

$$\delta_2 = -125 - (5\ 1) \begin{pmatrix} -15 \\ 0 \end{pmatrix} = -50$$

$$\delta_4 = -40 - (1\ 1) \begin{pmatrix} -15 \\ 0 \end{pmatrix} = -25$$

$\mathcal{X}_1 = 0 \quad \mathcal{X}_2 = 0$

$\mathcal{X}_4 = M$

$$-105x_1 - 125x_2 - 75x_3 - 40x_4 \to \max$$

$$\begin{cases} 5x_1 + 2x_2 + 5x_3 + x_4 \leq 2500 \\ 4x_1 + x_2 + x_3 + x_4 = 1500 \end{cases}$$

$$\begin{cases} 5x_1 + 2x_2 + 5x_3 + x_4 + x_5 = 2500 \\ 4x_1 + x_2 + x_3 + x_4 + x_6 = 1500 \end{cases}$$

$J_Б = \{5, 6\}$

Ограничи. на переменные?

$$u = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$\delta_1 = -105$

$\delta_2 = -125$

$\delta_3 = -75$

$\delta_4 = -40$

$\varkappa_1 = \varkappa_2 = \varkappa_3 = \varkappa_4 = 0$

$\varkappa_5 = 2500$

$\varkappa_6 = 1500$

$j_0 = 5$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad p = \begin{pmatrix} -1 \\ 0 \end{pmatrix}$$

$$\begin{cases} 5x_1 + 2x_2 + 5x_3 + x_4 = 2500 \\ 4x_1 + x_2 + x_3 + x_4 = 1500 \end{cases}$$

$$\begin{cases} 5u_1 + 4u_2 = 140 \\ 5u_1 + u_2 = 305 \end{cases}$$

$u_1 = 72$

$u_2 = -55$

$\Delta_2 = -89 < 0 \ (+) \quad x_2 = d_x$

$\Delta_4 = -11 < 0 \ (+) \quad x_4 = d_x$

Условия оптимальности выполняются

$X^0 = (333\frac{1}{3}, 0, 166\frac{2}{3}, 0)$ - оптимальный план

2) Двойственная задача

$\varphi(y) = 250y_1 + 150y_2 \to max$

$$\begin{cases} 0,5y_1 + 0,4y_2 \le 105 \\ 0,2y_1 + 0,1y_2 \le 125 \\ 0,5y_1 + 0,1y_2 \le 75 \\ 0,1y_1 + 0,1y_2 \le 40 \end{cases}$$

~~$y_1 \le 0 \quad y_2 \le 0$~~

$\Delta_4 = -\frac{4}{5} < 0$, $x_4 = d_{*4}$ (-1)

$\Delta_5 = -\frac{1}{5} > 0$, $x_5 = d_{*5}$ (-)

$J_0 = 1$

$l_1 = 1$

$l_2 = l_3 = l_4 = 0$

$$\begin{pmatrix} 5 & 0 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} l_3 \\ l_4 \end{pmatrix} = \begin{pmatrix} -5 \\ -4 \end{pmatrix} \quad l_3 = -1 \quad l_6 = -3$$

$\Theta_1 = \Theta_2 = \Theta_5 = \Theta_4 = \infty$

$\Theta_3 = \frac{0-500}{-1} = 500$

$\Theta_6 = \frac{-1-1000}{-3} = 333\frac{1}{3}$

$\Theta_0 = 333\frac{1}{3}$, $j_* = 6$

$x^2 = (333\frac{1}{3}, 0, 166\frac{2}{3}, 0, 0, 0)$

$J_Б = \{1, 3\}$

x_5, x_6 перешли из искусственных переменных в свободные, переходим ко второй фазе

$\varphi(x) = 140x_1 + 305x_3 \rightarrow max$

$j^* = 3$

$l_3 = 1$, $l_1 = l_2 = l_4 = 0$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} l_5 \\ l_6 \end{pmatrix} = \begin{pmatrix} -5 \\ -1 \end{pmatrix}$$

$l_5 = 1$

$l_6 = -1$

$\Theta_1 = \Theta_2 = \Theta_3 = \Theta_4 = \infty$

$$\Theta_5 = \frac{0-2500}{-5} = 500$$

$$\Theta_6 = \frac{0-1500}{-1} = 1500$$

$\Theta_0 = 500$ $\quad j^* = 5$

$x = (0, 0, 500, 0, 1000)$

$J_Б = \{3, 6\}$

Итерация 2

$-x_6 \to \max$

$$\begin{cases} u_2 = -1 \\ u_1 = \frac{1}{5} \end{cases} \qquad \begin{pmatrix} 5 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$$

$\Delta_1 = 4 > 0 \quad x_1 = d_* (-)$

$\Delta_2 = -\frac{3}{5} < 0 \quad x_2 = d_* (+)$

$-x_5 - x_6 \to max$

$$\begin{cases} 5x_1 + 2x_2 + 5x_3 + x_4 + x_5 = 2500 \\ 4x_1 + x_2 + x_3 + x_4 \quad + x_6 = 1500 \end{cases}$$

$x_1 \geq 0$

$x_2 \geq 0$

$x_3 \geq 0$

$x_4 \geq 0$

$0 \leq x_5 \leq 2500$

$\bar{X} = (0, 0, 0, 0, 2500, 1500)$

$J_5 = 15, 69$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} = \begin{pmatrix} -1 \\ -1 \end{pmatrix}$$

$u_1 = u_2 = -1$

$$\Delta_1 = 0 - (5, 4) \begin{pmatrix} -1 \\ -1 \end{pmatrix} = 9 > 0 \quad x_1 = d_* (-)$$

$$\Delta_2 = 0 - (2, 1) \begin{pmatrix} -1 \\ -1 \end{pmatrix} = 3 > 0 \quad x_2 = d_* (-)$$

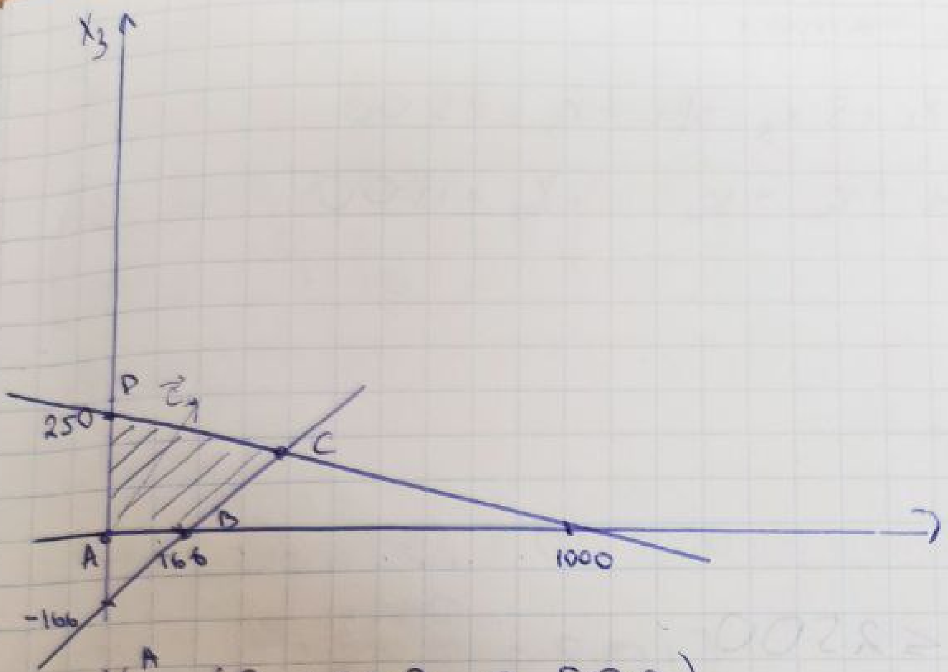
$\Delta_3 = 6 > 0 \quad x_3 = d_* (-)$

$\Delta_4 = 2 > 0 \quad x_4 = d_* (-)$

$j^* =$

$l_3 =$

l_5



$X^A = (0, 1000, 0, 500)$

$X^B = (166\frac{1}{3}, 833\frac{2}{3}, 0, 1)$

$X^C = (333\frac{1}{3}, 0, 166\frac{2}{3}, 0)$

$X^D = (0, 0, 250, 1250)$

Для $\bar{\varphi}(x) = -105x_1 - 125x_2 - 75x_3 - 40x_4 \to max$

т. max $X_C\ (333\frac{1}{3}, 0, 166\frac{2}{3}, 0)$

т. min $X_B\ (166\frac{1}{3}, 833\frac{2}{3}, 0, 1)$

$\tilde{x} = (0, 0, 0, 0)$

$w = \begin{pmatrix} 2500 \\ 1500 \end{pmatrix} > 0$

$\tilde{x}$ - план задачи

Задана в каком виде.

1.10

3) 10)

$\varphi(x) = 105x_1 + 125x_2 + 75x_3 + 40x_4 \to \min$

$\bar{\varphi}(x) = -105x_1 - 125x_2 - 75x_3 - 40x_4 \to \max$

$\begin{cases} 0{,}5x_1 + 0{,}2x_2 + 0{,}5x_3 + 0{,}1x_4 = 250 \\ 0{,}4x_1 + 0{,}1x_2 + 0{,}1x_3 + 0{,}1x_4 = 150 \end{cases}$

$\begin{cases} 5x_1 + 2x_2 + 5x_3 + x_4 = 2500 \\ 4x_1 + x_2 + x_3 + x_4 = 1500 \end{cases}$

$3x_1 - 3x_3 + x_4 = 500$

$x_4 = 500 - 3x_1 + 3x_3 \geq 0$

$x_2 = 1500 - 4x_1 - x_3 - 500 + 3x_1 - 3x_3 =$

$= 1000 - x_1 - 4x_3 \geq 0$

$\begin{cases} 125x_2 = 125000 - 125x_1 - 500x_3 \\ 40x_4 = 20000 - 120x_1 + 120x_3 \end{cases}$

$\bar{\varphi}(x) = -105x_1 - 125000 + 125x_2 + 500x_3 -$

$- 20000 + 120x_1 - 120x_3 - 75x_3 \to \max$

$\bar{\varphi}(x) = 140x_1 + 305x_3 + C \to \max$

$C = -145000$

$\begin{cases} 3x_1 - 3x_3 \leq 500 \\ x_1 + 4x_3 \leq 1000 \end{cases}$