Задание 7

5. $\begin{cases} 3X_1 & -X_3 & +X_5 & = 30 \\ -2X_1 & & +3X_4 & = -11 \\ & 4X_2 & +X_5 & = 2 \end{cases}$

$\varphi(X) = 5X_1 \quad -4X_3 + 15X_4 + 5X_5 \to \max$

$2 \leq X_1 \leq 10$

$0 \leq X_2 \leq 4$

$1 \leq X_3 \leq 5$

$0 \leq X_4 \leq 4$

$-1 \leq X_5 \leq 3$

Первая фаза

$\overline{X} = (10, 0, 1, 0, -1)$

$w = \begin{pmatrix} 30 \\ -11 \\ 2 \end{pmatrix}' - \begin{pmatrix} 3 & 0 & -1 & 0 & 1 \\ -2 & 0 & 0 & 3 & 0 \\ 0 & 4 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 10 \\ 0 \\ 1 \\ 0 \\ -1 \end{pmatrix} =$

$= \begin{pmatrix} 30 \\ -11 \\ 2 \end{pmatrix} - \begin{pmatrix} 28 \\ -20 \\ -1 \end{pmatrix} = \begin{pmatrix} 2 \\ 9 \\ 3 \end{pmatrix} \begin{matrix} > 0 \\ > 0 \\ > 0 \end{matrix}$

$\varphi'(X) = -X_6 - X_7 - X_8 \to \max$

$\begin{cases} 3X_1 & -X_3 & +X_5 +X_6 & & = 30 \\ -2X_1 & +3X_4 & & +X_7 & = -11 \\ & 4X_2 & +X_5 & & +X_8 = 2 \end{cases}$

$0 \le x_6 \le 2$

$0 \le x_7 \le 9$

$0 \le x_8 \le 3$

① Итерация

1. $(u_1 \ u_2 \ u_3) \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = (-1 \ -1 \ -1)$

$u = (-1 \ -1 \ -1)$

2. $\Delta_1 = 0 - (-1 \ -1 \ -1) \begin{pmatrix} -\frac{3}{2} \\ 0 \\ 0 \end{pmatrix} = 1 \ge 0, \ x_1 = d^+$ ⊕

$\Delta_2 = 0 - (-1 \ -1 \ -1) \begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix} = 4 \ge 0, \ x_2 = d_* $ ⊖

4. $J_* = 2, \ \ell_2 = 1$.

$\ell_1 = \ell_3 = \ell_4 = \ell_5 = 0$

$\ell_6 = 0, \ \ell_7 = 0, \ \ell_8 = -4$

5. $Q_1 = Q_3 = Q_4 = Q_5 = Q_6 = Q_7 = \infty$

$Q_2 = 4 - 0 = 4$

$Q_8 = \dfrac{0-3}{-4} = 0,75$

6. $\theta^0 = Q_8 = 0,75$

7. $J_6 = \{2, 6, 7\}$

8. $\bar{x} = (10 \ 0 \ 1 \ 0 \ -1 \ 2 \ 9 \ 3) - 0,75(0, 1, 0, 0, 0, 0, 0, 0)$

$= (10 \ \frac{3}{4} \ 1 \ 0 \ -1 \ 2 \ 9 \ 0)$

② Итерация

$$1.\ (u_1,\ u_2,\ u_3)\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 4 & 0 & 0 \end{pmatrix} = (0\quad -1\ -1)$$

$$u' = (-1\quad -1\quad 0)$$

$$2.\ \Delta_1 = 0 - (-1\ -1\ 0)\begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} = 1 \geq 0,\ X_1 = 10$$

$$\Delta_3 = 0 - (-1\ -1\ 0)\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = -1 \leq 0,\ X_2 = 1 +$$

$$\Delta_4 = 0 - (-1\ -1\ 0)\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = 3 \geq 0,\ X_3 = 0 \rightarrow$$

$$4.\ J_0 = 4,\ l_4 = \ 1$$

$$l_1 = l_3 = l = l_5 = l_8 = 0$$

$$l_2 = 0,\ l_6 = 0,\ l_7 = -3$$

$$5.\ \theta_1 = \theta_2 = \theta_3 = \theta_5 = \theta_8 = \theta_6 = \infty$$

$$\theta_4 = 4$$

$$\theta_7 = \frac{0 - 9}{-3} = 3$$

$$6.\ \theta^0 = \theta_7 = 3$$

$$7.\ \overline{J_b} = \{2, 6, 7\} \cup \{4\} / \{7\} = \{2, 4, 6\}$$

$$8.\ X = (10\quad \tfrac{3}{4}\quad 1\quad 3\quad -1\quad 2.0\quad 0)$$

③ Итерация

$$1.\ (u_1,\ u_2,\ u_3)\begin{pmatrix} 0 & 0 & 1 \\ 0 & 3 & 0 \\ 4 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ -1 \end{pmatrix}^{\mathsf{T}}$$

$$u' = (-1\quad 0\quad 0)$$

$$2.\ \Delta_1 = 0 - (-1\ 0\ 0)\begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} = 3 \geq 0,\ X_1 = 10 = \delta^{x} \ \oplus$$

$$\Delta_3 = 0 - (-1 \; 0 \; 0)\begin{pmatrix} -1 \\ 0 \\ 0 \end{pmatrix} = -1 \leq 0, x_3 = 1 = d_* \;\oplus$$

$$\Delta_5 = 0 - (-1 \; 0 \; 0)\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = 1 \geq 0, x_5 = -1 = d_* \;\ominus$$

4. $J_0 = 5$, $\ell_5 = 1$

$$\ell_1 = \ell_3 = \ell_7 = \ell_8 = 0$$

$$\ell_2 = -0,25 \;, \; \ell_4 = 0, \; \ell_6 = -1$$

$$(0, -0,25, 0, 0, 1, -1, 0, 0)$$

5. $\theta_1 = \theta_3 = \theta_4 = \theta_7 = \theta_8 = \infty$

$$\theta_5 = 3 + 1 = 4$$

$$\theta_2 = \frac{0 + 0,75}{-0,25} = 3, \; \theta_6 = \frac{0 - 2}{-1} = 2$$

6. $\theta^0 = \theta_6 = 2$

7. $\overline{J_\delta} = \{2, 4, 6\} \cup \{5\} / \{6\} = \{2, 4, 5\}$

8. $\overline{x} = (10 \; \tfrac{7}{4} \; 1 \; 3 \; 1 \; 0 \; 0 \; 0)$

④ Итерация

1. $(u_1, u_2, u_3)\begin{pmatrix} 0 & 0 & 1 \\ 0 & 3 & 0 \\ 4 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$

$$u' = (0 \; 0 \; 0)$$

2. $\Delta_1 = 0 - (0 \; 0 \; 0) = 0, x_1 = 10 = d^* \;\oplus$

$$\Delta_3 = 0 = 0, \; x_3 = 1 = d_* \quad \oplus$$

$$\Delta_6 = -1 \leq 0, \; x_6 = 0 = d_* \quad \oplus$$

$$\Delta_7 = -1 \leq 0, \; x_7 = 0 = d_* \quad \oplus$$

$$\Delta_8 = -1 \leq 0, \; x_8 = 0 = d_* \quad \oplus$$

$$\overline{J_\delta} \cap J_n = \emptyset$$
$$x_n = 0 \Rightarrow \text{Реш}$$
$$\text{исход}$$

2 Фаза

$x = \begin{pmatrix} 10 & \frac{1}{4} & 1 & 3 & 1 \end{pmatrix}$

$J_Б = \{2, 4, 5\}$

① Итерация

1. $(u_1 \; u_2 \; u_3) \begin{pmatrix} 0 & 0 & 1 \\ 0 & 3 & 0 \\ 4 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 15 \\ 5 \end{pmatrix}^T$

$u' = (5 \; 5 \; 0)$

2. $\Delta_1 = 5 - (5 \; 5 \; 0)\begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} = 5 - 5 = 0$ ⊕

$\Delta_3 = -4 - (5 \; 5 \; 0)\begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} = 1 > 0, \; X_3 = 1 = d_*$ ⊖

4. $J_0 = 3 \quad l_3 = 1$

$l_1 = 0$

$l_2 = -\frac{1}{4}, \quad l_4 = 0, \; l_5 = 1$

$l = \begin{pmatrix} 0 & -\frac{1}{4} & 1 & 0 & 1 \end{pmatrix}$

5. $\theta_3 = 5 - 1 = 4$

$\theta_1 = \theta_4 = \infty \qquad \theta_5 = \frac{3-1}{1} = 2$

$\theta_2 = \frac{0 - \frac{1}{4}}{-\frac{1}{4}} = 1$

6. $\theta^0 = \theta_2 = 1$

7. $J_Б = \{2, 4, 5\} \cup \{3\} / \{2\} = \{3, 4, 5\}$

8. $\overline{x} = \begin{pmatrix} 10 & 0 & 2 & 3 & 2 \end{pmatrix}$

② Итерация

1. $(u_1 \quad u_2 \quad u_3)\begin{pmatrix} -1 & 0 & 1 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} -4 \\ 15 \\ 5 \end{pmatrix}$

$u' = (4 \quad 5 \quad 1)$

2. $\Delta_1 = 5 - (+4 \quad 5 \quad 1)\begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} = 5 - 2 = 3 \geq 0, \; X_1 = 10 = d^+ \oplus$

$\Delta_2 = 0 - (4 \quad 5 \quad 1)\begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix} = -4 < 0, \; X_2 = 0 = d_* \oplus$

Ответ: $X = (10 \quad 0 \quad 2 \quad 3 \quad 2)$, $\varphi(X) = 97$