$Q = 2I \; ; \; d = \begin{bmatrix} -2 \\ -5 \end{bmatrix}.$

$a_1 = \begin{bmatrix} 1 \\ -2 \end{bmatrix}; \; a_2 = \begin{bmatrix} -1 \\ -2 \end{bmatrix} \; a_3 = \begin{bmatrix} -1 \\ 2 \end{bmatrix}; a_4 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}; \; a_5 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$

$x^{(0)} = \begin{bmatrix} 2 \\ 0 \end{bmatrix} \quad \Big\| \; b_1 = -2, \; b_2 = -6, \; b_3 = -2, \; b_4 = b_5 = 0$

$W_0 = \{3, 5\}. \quad g_0 = Q x_0 + d = 2x_0 + d$

$= 2\begin{bmatrix} 2 \\ 0 \end{bmatrix} + \begin{bmatrix} -2 \\ -5 \end{bmatrix} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}.$

$\lambda_3 \begin{bmatrix} -1 \\ 2 \end{bmatrix} + \lambda_5 \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ -5 \end{bmatrix}$

$-\lambda_3 = 2 \qquad \lambda_3 = -2$

$2\lambda_3 + \lambda_5 = -5 \; ; \; -4 + \lambda_5 = -5$

$\lambda_5 = -1.$

$W_1 = \{5\}$. $g_1 = g_0$ as @ $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$.

Solve $\quad \min \frac{1}{2} p^T Q p + g^{(0)T} p$

$\quad\quad$ st $a_i^T p = 0 \quad i = 5$.

$\quad\quad \equiv p_y = 0$

$\therefore \min \quad p_x^2 + \begin{bmatrix} 2 \\ -5 \end{bmatrix}^T \begin{bmatrix} p_x \\ 0 \end{bmatrix} = p_x^2 + 2p_x$

min @ $p_x = -1$ ✓

$\therefore p^{(1)} = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$.

Step len fun.

$$\alpha = \min \left\{ 1, \min_{\substack{i \in W_1^c \\ a_i^T p < 0}} \left\{ \frac{b_i - a_i^T x^1}{a_i^T p} \right\} \right.$$

③

$i=1 \quad a_i^T p^1 = [1, -2]\begin{bmatrix}-1\\0\end{bmatrix} = -1$ ✓ $\quad \dfrac{-2-[1,-2]\begin{bmatrix}2\\0\end{bmatrix}}{-1}$

$2 \quad '' \quad [-1,-2]\begin{bmatrix}-1\\0\end{bmatrix} = 1$ × $\quad = \dfrac{-2-2}{-1} = \textcircled{4}$

$3 \quad '' \quad [-1,-2]\begin{bmatrix}-1\\0\end{bmatrix} = 1$ ×

$4 \quad '' \quad [1 \ \ 0]\begin{bmatrix}-1\\0\end{bmatrix} = -1$ ✓ $\quad \dfrac{0-[1,0]\begin{bmatrix}2\\0\end{bmatrix}}{-1} = \textcircled{2}$

So $\alpha = 1$ as $1 < 4, 2$ ✓ (Con 4 will be "hit" first, seeding.)

$$\text{Min} \quad \|p\|^2 + g^{(2)T} p$$

$$g^{(2)} = \quad 2x^{(2)} + d = 2\begin{pmatrix}1\\0\end{pmatrix} + \begin{pmatrix}-2\\-5\end{pmatrix} = \begin{pmatrix}0\\-5\end{pmatrix}$$

$$\text{st} \quad a_5^T p = 0 \quad \equiv \quad p_y = 0.$$

$$\text{so} \quad \min \; p_x^2 + 0\,p_x \checkmark$$

$$\underline{p^{(2)} = \underline{0}}$$

$$\lambda_5 \, a_5 = g^{(2)} \quad \equiv \quad \lambda_5 \begin{pmatrix}0\\1\end{pmatrix} = \begin{pmatrix}0\\-5\end{pmatrix} \checkmark$$

$$W^3 = \{\}. \qquad g^{(3)} = 2x^{(3)} + d = g^{(2)} = \begin{pmatrix}0\\-5\end{pmatrix}$$

$$\text{Min} \quad \|p\|^2 + g^{(3)T} p \quad = \quad p_x^2 + p_y^2 - 5p_y.$$

$$p_x = 0; \quad p_y = 2\tfrac{1}{2}$$

$$p = \begin{pmatrix}0\\2\tfrac{1}{2}\end{pmatrix}.$$

(5)

$r = (2\frac{1}{2})$

$a_1^T \binom{0}{2\frac{1}{2}} = -5$ ✓

$a_2^T \binom{0}{2\frac{1}{2}} = -5$ ✓

$a_3^T \binom{0}{2\frac{1}{2}} = 5$ ×

$a_4^T \binom{0}{2\frac{1}{2}} = 0$ ×

$a_5^T \binom{0}{2\frac{1}{2}} = 2\frac{1}{1}$ ×

$$\frac{b_1 - a_1^T x}{-5} = \frac{-2 - [1, -2]\left[\binom{1}{0}\right]}{-5} = \cancel{-2} + \frac{-2-1}{-5} = \frac{3}{5} \cdot \text{⊛}$$

$$\rightarrow \frac{-6 - \begin{bmatrix} -1 \\ -2 \end{bmatrix}^T \begin{bmatrix} 0 \\ 2\frac{1}{2} \end{bmatrix}}{-5} = \frac{-6+5}{-5} = 1.$$

So $\alpha = 3/5$, ① enters W

$\underline{\underline{2}}$ $x \rightarrow \binom{1}{0} + \frac{3}{5}\binom{0}{2\frac{1}{2}} = \underline{\underline{\binom{1}{3/2}}}$

$g^{(w)} = 2x + c$

$= 2\binom{1}{3/2} + \binom{-2}{-5}$

$= \binom{0}{-2}.$

$$\min \|p\|^2 + g^T p = \|p\|^2 - 2p_y$$

$$\text{st } a_1^T p = 0 \equiv p_x - 2p_y = 0$$

✓