$$\max \quad v_1 x_1 + v_2 x_2 = W$$

$$x_1 \leq z_1 \qquad (\rho_1)$$

$$x_2 \leq z_2 \qquad (\rho_2)$$

$$x_1, x_2 \leq 1$$

$$z_1 + z_2 \leq 1$$

$$\max \quad v_1 x_1 + v_2 x_2 + \rho_1 (z_1 - x_1) + \rho_2 (z_2 - x_2)$$

$$\text{s.t.} \quad x_1, x_2 \leq 1$$

$$z_1 + z_2 \leq 1$$

$$\text{---------} \quad + \quad \text{---------}$$

$$(v_1 - \rho_1) x_1 + (v_2 - \rho_2) x_2 + \rho_1 z_1 + \rho_2 z_2$$

$$x_1 \text{ or } x_2 \leq 1$$

$$z_1 + z_2 \leq 1$$

$$F(p_1, p_2) =$$

$$\max \quad (v_1 - p_1)x_1 + (v_2 - p_2)x_2 + p_1 z_1 + p_2 z_2$$

$$x_1, x_2 \leq 1$$

$$z_1 + z_2 \leq 1$$

$$W = \min_{p_1, p_2 \geq 0} F(p_1, p_2)$$

$$p^{t+1} = p^t + \Delta^t \cdot s^t$$

Δ^t: step size

s^t: subgradient

$$s^t = \begin{bmatrix} x_1^t - z_1^t \\ x_2^t - z_2^t \end{bmatrix}$$

$s^t \to 0$

$\sum s^t \to \infty$

} sufficient for cvg.

1) Choice of subgradient

2) Choice of step size

3) Primal - Dual

4) Bundle methods

Surrogate Gradient