1a) $$\begin{bmatrix} 0 & C_{xy} \\ C_{yx} & 0 \end{bmatrix} \begin{bmatrix} w_x \\ w_y \end{bmatrix} = \lambda \begin{bmatrix} C_{xx} & 0 \\ 0 & C_{yy} \end{bmatrix} \begin{bmatrix} w_x \\ w_y \end{bmatrix}$$

$$\Leftrightarrow \begin{aligned} &(1) \quad C_{xy} w_y = \lambda C_{xx} w_x \\ &(2) \quad C_{yx} w_x = \lambda C_{yy} w_y \end{aligned}$$

$$(1) \Leftrightarrow \quad w_x^T C_{xy} w_y = \lambda \underbrace{w_x^T C_{xx} w_x}_{=1}$$

Objective: $\max(w_x^T C_{xy} w_y)$ $\Rightarrow$ pick solution (w_x, w_y) that corresponds to largest λ

analogously:

$$(2) \Leftrightarrow \quad C_{yx} w_x = \lambda C_{yy} w_y$$

$$w_y^T C_{yx} w_x = \lambda \underbrace{w_y^T C_{yy} w_y}_{=1}$$

$$w_y^T C_{yx} w_x = w_x^T C_{xy} w_y = \lambda$$

b) (1) $(-w_x)^T C_{xy} (-w_y) = (-1) w_x^T C_{xy} w_y \cdot (-1) = w_x^T C_{xy} w_y$

(2) $-w_x^T C_{xx} (-w_x) = w_x^T C_{xx} w_x$

analogously to (2) for second constraint $w_y^T C_{yy} w_y = 1$

As objective and restrictions have same results for (w_x, w_y) and $(-w_x, -w_y)$, $(-w_x, -w_y)$ is always as good a solution if w_x, w_y is a solution.