KUHN - TUCKER CONDITIONS

THE DEVELOPMENT OF THESE CONDITIONS ARE BASED ON A GENERALIZED VIEW OF THE LAGRANGEAN

OPTIMIZE $g(x)$

s.t. $h_j(x) \leq b_j \qquad x \geq 0$

CONVERTED TO

OPTIMIZE $g(x)$

S.T. $h_j(x) + s_j^2 = b_j \qquad x \geq 0$

THE GENERALIZED LAGRANGEAN IS THEN WRITTEN AS:

$$\mathcal{L} = g(x) - \sum \lambda_j \left(h_j(x) + s_j^2 - b_j \right)$$

$$\left.\begin{array}{l} \dfrac{\partial \mathcal{L}}{\partial x_i} = 0 \\[2ex] \dfrac{\partial \mathcal{L}}{\partial \lambda_j} = 0 \\[2ex] \dfrac{\partial \mathcal{L}}{\partial s_j} = -2\lambda_j s_j = 0 \Rightarrow \lambda_j s_j = 0 \\[2ex] \text{SIGN CONSTRAINT ON } \lambda_j \end{array}\right] \text{KUHN TUCKER CONDITIONS}$$

DIRECTION	$\leq$	$\geq$	$=$
MAXIMIZE	INCREASING b_j WILL INCREASE THE SIZE OF THE FEASIBLE ZONE. THIS CAN ONLY IMPROVE (INCREASE) $g^*(x)$. $\lambda_j \geq 0$	Increasing b_j will decrease the size of the feasible zone. This can only reduce $g^*(x)$. $\lambda_j \leq 0$	Nothing can be said about the size of the feasible zone. Hence λ_j unrestricted in sign
MINIMIZE	Increasing b_j will increase the size of the feasible zone. This can only improve (DECREASE) $g^*(x)$. $\lambda_j \leq 0$	Increasing b_j will decrease the size of the feasible zone. This can only increase $g^*(x)$. $\lambda_j \geq 0$	Same as above. λ_j unrestricted in sign

NOTE $\dfrac{\partial g^*}{\partial b_i} = \lambda_j$