T Value Computation

A system of constraints:

$$
(1)\quad
\begin{array}{l}
a_{11} x_1 + a_{12} x_2 + \dots a_{1N} x_N > b_1 \\
a_{21} x_1 + a_{22} x_2 + \dots a_{2N} x_N > b_2 \\
\vdots \\
a_{M1} x_1 + a_{M2} x_2 + \dots a_{MN} x_N > b_M
\end{array}
$$

may be expressed as:

$$
(2)\quad
\begin{array}{l}
\vec{a}_1 \cdot \vec{r} > b_1 \\
\vec{a}_2 \cdot \vec{r} > b_2 \\
\vdots \\
\vec{a}_M \cdot \vec{r} > b_M
\end{array}
$$

where

$$(3)\quad \vec{a}_M = a_{M1} \vec{e}_1 + a_{M2} \vec{e}_2 + \dots a_{MN} \vec{e}_N$$

$$(4)\quad \vec{e}_J \qquad (j = 1,2,\dots n)$$

being unit directional vectors, and

$$(5)\quad \vec{r} = x_1 \vec{e}_1 + x_2 \vec{e}_2 + \dots x_N \vec{e}_N$$

is a vector to point (x_1 , x_2 , ... x_N) in n space. For purposes of T value computation, the inequality constraint in (1) is replaced by equality constraints. Therefore (2) now becomes:

$$
(6)\quad
\begin{array}{l}
\vec{a}_1 \cdot \vec{r} = b_1 \\
\vec{a}_2 \cdot \vec{r} = b_2 \\
\vdots \\
\vec{a}_M \cdot \vec{r} = b_M
\end{array}
$$

and represents the set of constraint hyperplanes in n space.

In general, a point in n space in given by the vector equation:

(7) $\vec{r} = \vec{r}_o + T\vec{g}$

where $\vec{r}_o$ and $\vec{g}$ are known vectors, and T is a scalar parameter on $\vec{g}$ (figure 1).

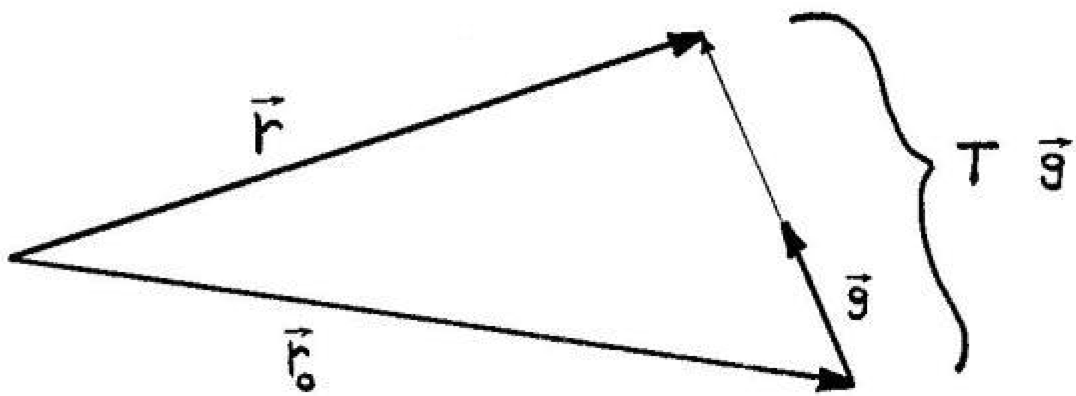

Figure 1

To determine the value of T, put (7) into (6) and solve for T:

$$\vec{a}_i \bullet \vec{r} = b_i$$

$$\vec{a}_i \bullet (\vec{r}_o + T_i\vec{g}) = b_i$$

$$\vec{a}_i \bullet \vec{r}_o + T_i \vec{a}_i \bullet \vec{g} = b_i$$

Solving for T we have:

(8) $T_i = (b_i - \vec{a}_i \bullet \vec{r}_o)/(\vec{a}_i \bullet \vec{g})$

(i = 1 , 2 , ... m constraint hyperplanes)

Equation (8), as applied to Mutation Geometry based linear programming, is used to determine the parametric " distance " (T) between constraint hyperplanes, along the direction of vector $\vec{g}$. In operation, $\vec{a}$, $\vec{r}_o$, $\vec{g}$, and b are known and values of T are computed for each constraint hyperplane each iteration (figure 2).

T_2, T_3 WILL BE NEGATIVE

	X	Y	≥	B
①	1	0	≥	0
②	0	1	≥	0
③	1	7	≥	7
④	2	6	≥	12
⑤	3	5	≥	15
⑥	4	4	≥	16
⑦	5	3	≥	15
⑧	6	2	≥	12
⑨	7	1	≥	7
OBJ =	1	1		

MINIMIZE

$$T_i = (b_i - \vec{a}_i \cdot \vec{r}_0)/(\vec{a}_i \cdot \vec{g})$$

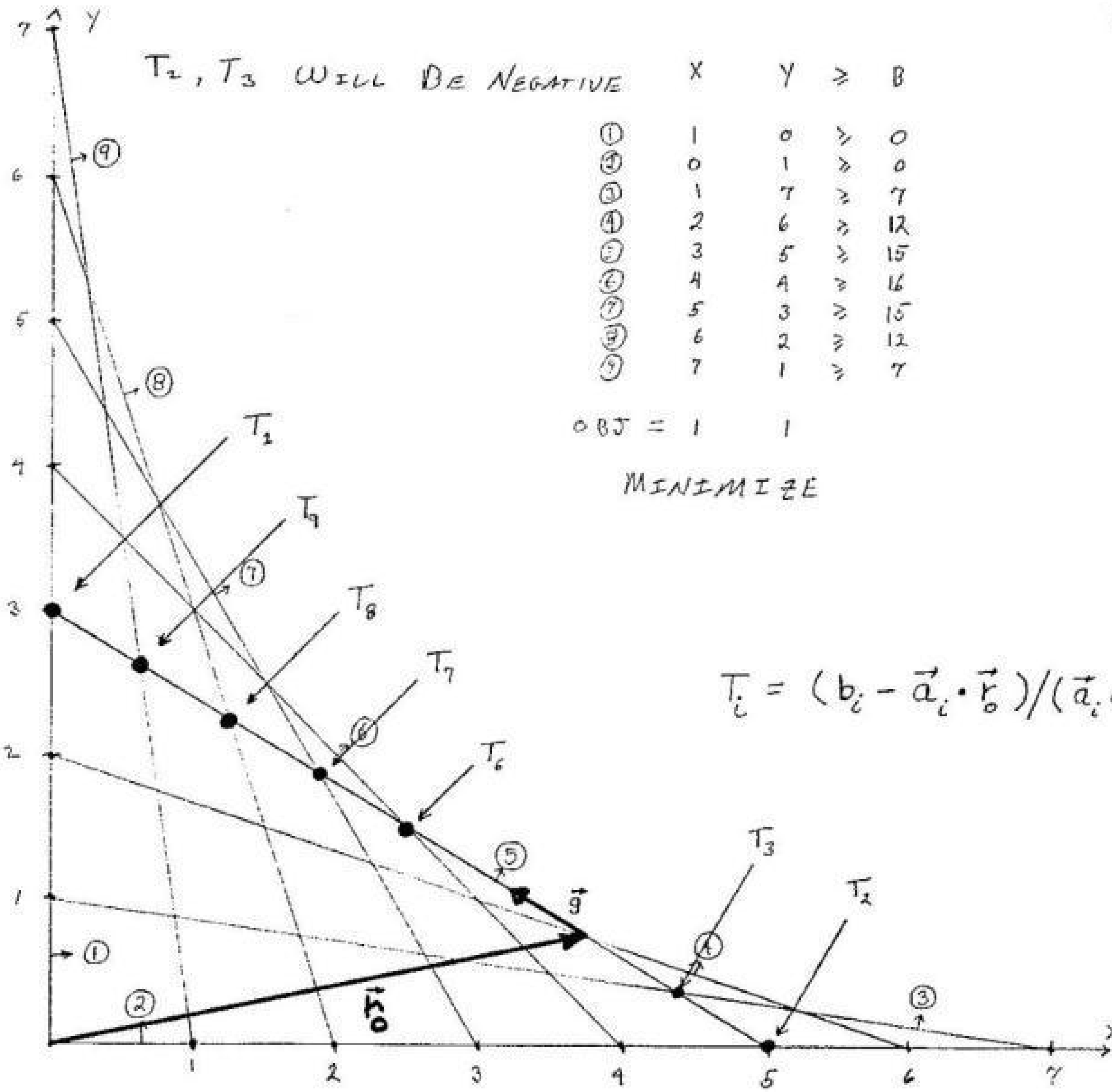

FIGURE 2