LB - Liste von Basen; LPx - Liste von Pareto-optimalen Extrempunkten

LPv - Liste von Pareto-optimalen Strahlen (charakterisiert durch $(x_B, r^j)$, wobei $x_B$ und $r^j$ jeweils den Extrempunkt und die Richtung darstellen)

**Algorithm 5.2 (Multicriteria Simplex Algorithm)**

*Initialization:* Set $LB := \emptyset$, $LPX := \emptyset$, $LPU := \emptyset$.
*Step 1 a)* Solve the linear program

$$\begin{aligned} &\min e^t \hat{x} \\ &\text{subject to} Ax + I\hat{x} = b \\ &x, \hat{x} \geq 0. \end{aligned}$$

*b)* If this LP is unbounded or if the optimal solution is nonzero, STOP, $X = \emptyset$. Otherwise go to Step 2 with a basic feasible solution $x^0$ of MCLP.
*Step 2 a)* Solve the linear program (D)

$$\begin{aligned} &\min u^t b + w^t C x^0 \\ &\text{subject to } u^t A + w^t C \geq 0 \\ &w \geq e. \end{aligned}$$

*b)* If (D) is unbounded, STOP, $X_{\text{Par}} = \emptyset$. Otherwise let $(u^*, w^*)$ be an optimal solution and go to c)

*c)* Solve the linear program LP($w^*$)

$$\begin{aligned} &\min w^{*t} C x \\ &\text{subject to } Ax = b \\ &x \geq 0. \end{aligned}$$

Add the optimal basis found for LP($w^*$) to LB, the corresponding optimal extreme point to LPX and go to Step 3.
*Step 3 a)* If $LB = \emptyset$ STOP: All Pareto optimal extreme points and unbounded edges are found. Otherwise choose a basis $B$ in LB, remove it from LB, and go to b)
*b)* For all variables $x_j$ which are nonbasic at basis $B$ solve the linear program (SP)

$$\begin{aligned} &\max e^t v \\ &\text{subject to } Ry - r^j \delta + Iv = 0 \\ &y, \delta, v \geq 0. \end{aligned}$$

If (SP) has an optimal solution do the following. For all feasible pivots with $x_j$ entering,

- perform the pivot,
- add the adjacent efficient basis to LB, if it is new,
- add the corresponding extreme point to LPX, if it is new,
- add the corresponding unbounded Pareto optimal edges emanating from $x_B$ to LPU, if the pivot column has only negative entries.

Go to Step 3 a)