

Read in the following dictionary:

$x_6$	17.0	$-1.00x_1 - 8.00x_2 + 3.00x_3 - 7.00x_4$	
$x_7$	-3.0	$+4.00x_1 + 7.00x_2 + 9.00x_3 - 10.00x_4 - 4.00x_5$	
$x_8$	31.0	$-7.00x_1 - 9.00x_2 + 4.00x_3$	$+6.00x_5$
$x_9$	5.0	$-9.00x_1 + 7.00x_2 + 5.00x_3$	$-1.00x_5$
$x_{10}$	0.0	$-9.00x_1 + 8.00x_2 + 8.00x_3 + 1.00x_4 + 8.00x_5$	
$x_{11}$	37.0	$-7.00x_1 - 8.00x_2 + 2.00x_3 + 5.00x_4 - 5.00x_5$	
$x_{12}$	-2.0	$+3.00x_1 + 9.00x_2 - 2.00x_3 + 1.00x_4 + 10.00x_5$	
$x_{13}$	-40.0	$+7.00x_1 + 5.00x_2 + 10.00x_3$	$+10.00x_5$
$x_{14}$	10.0	$+3.00x_1 - 6.00x_2 - 3.00x_3 + 5.00x_4 - 10.00x_5$	
$z$	0.0	$-4.00x_1 + 3.00x_2 + 2.00x_3 - 3.00x_4 + 2.00x_5$	

## 0.1 Initialization Phase: Dual Problem Solving

New Objective in primal was changed to :

$$\max \sum_{j=1}^5 -x_j$$

Primal variable  $x_j$  corresponds to dual variable  $y_j$  for  $j = 1, \dots, 14$  Dual Dictionary (with objective changed is):

$y_1$	1.0	$+1.00y_6 - 4.00y_7 + 7.00y_8 + 9.00y_9 + 9.00y_{10} + 7.00y_{11} - 3.00y_{12} - 7.00y_{13} - 3.00y_{14}$
$y_2$	1.0	$+8.00y_6 - 7.00y_7 + 9.00y_8 - 7.00y_9 - 8.00y_{10} + 8.00y_{11} - 9.00y_{12} - 5.00y_{13} + 6.00y_{14}$
$y_3$	1.0	$-3.00y_6 - 9.00y_7 - 4.00y_8 - 5.00y_9 - 8.00y_{10} - 2.00y_{11} + 2.00y_{12} - 10.00y_{13} + 3.00y_{14}$
$y_4$	1.0	$+7.00y_6 + 10.00y_7$ $-1.00y_{10} - 5.00y_{11} - 1.00y_{12} - 5.00y_{14}$
$y_5$	1.0	$+4.00y_7 - 6.00y_8 + 1.00y_9 - 8.00y_{10} + 5.00y_{11} - 10.00y_{12} - 10.00y_{13} + 10.00y_{14}$
$z$	-0	$-17.00y_6 + 3.00y_7 - 31.00y_8 - 5.00y_9$ $-37.00y_{11} + 2.00y_{12} + 40.00y_{13} - 10.00y_{14}$

Initialization succeeded in finding final dual dictionary with 6 pivots

$y_{14}$	0.0391304347826	$+0.26y_6 + 0.04y_3 + 1.37y_8 + 1.34y_9 + 1.90y_{10} + 0.76y_{11} - 0.32y_7 + 0.05y_5 - 0.1$
$y_{12}$	0.0228260869565	$+0.40y_6 + 0.11y_3 + 0.63y_8 + 1.28y_9 + 1.11y_{10} + 1.03y_{11} + 0.90y_7 - 0.06y_5 - 0.0$
$y_2$	0.447826086957	$+6.65y_6 - 0.39y_3 + 10.83y_8 - 11.29y_9 - 6.54y_{10} + 2.15y_{11} - 12.90y_7 + 0.77y_5 + 0.1$
$y_4$	0.78152173913	$+5.29y_6 - 0.33y_3 - 7.50y_8 - 8.00y_9 - 11.63y_{10} - 9.83y_{11} + 10.71y_7 - 0.18y_5 + 0.7$
$y_{13}$	0.116304347826	$-0.14y_6 - 0.07y_3 + 0.14y_8 + 0.16y_9 - 0.01y_{10} + 0.23y_{11} - 0.82y_7 + 0.00y_5 - 0.0$
$z$	4.30652173913	$-24.46y_6 - 2.83y_3 - 37.90y_8 - 9.48y_9 - 17.08y_{10} - 33.21y_{11} - 24.69y_7 - 0.46y_5 - 1.0$

Primal Dictionary is:

$x_6$	24.4565217391	$-0.26x_{14}$	$-0.40x_{12}$	$-6.65x_2$	$-5.29x_4$	$+0.14x_{13}$
$x_3$	2.82608695652	$-0.04x_{14}$	$-0.11x_{12}$	$+0.39x_2$	$+0.33x_4$	$+0.07x_{13}$
$x_8$	37.9043478261	$-1.37x_{14}$	$-0.63x_{12}$	$-10.83x_2$	$+7.50x_4$	$-0.14x_{13}$
$x_9$	9.47608695652	$-1.34x_{14}$	$-1.28x_{12}$	$+11.29x_2$	$+8.00x_4$	$-0.16x_{13}$
$x_{10}$	17.0826086957	$-1.90x_{14}$	$-1.11x_{12}$	$+6.54x_2$	$+11.63x_4$	$+0.01x_{13}$
$x_{11}$	33.2065217391	$-0.76x_{14}$	$-1.03x_{12}$	$-2.15x_2$	$+9.83x_4$	$-0.23x_{13}$
$x_7$	24.6869565217	$+0.32x_{14}$	$-0.90x_{12}$	$+12.90x_2$	$-10.71x_4$	$+0.82x_{13}$
$x_5$	0.458695652174	$-0.05x_{14}$	$+0.06x_{12}$	$-0.77x_2$	$+0.18x_4$	$-0.00x_{13}$
$x_1$	1.02173913043	$+0.13x_{14}$	$+0.08x_{12}$	$-0.17x_2$	$-0.73x_4$	$+0.05x_{13}$
$z$	-4.30652173913	$-0.04x_{14}$	$-0.02x_{12}$	$-0.45x_2$	$-0.78x_4$	$-0.12x_{13}$

Primal Dictionary with original objective is:

$x_6$	24.4565217391	$-0.26x_{14}$	$-0.40x_{12}$	$-6.65x_2$	$-5.29x_4$	$+0.14x_{13}$
$x_3$	2.82608695652	$-0.04x_{14}$	$-0.11x_{12}$	$+0.39x_2$	$+0.33x_4$	$+0.07x_{13}$
$x_8$	37.9043478261	$-1.37x_{14}$	$-0.63x_{12}$	$-10.83x_2$	$+7.50x_4$	$-0.14x_{13}$
$x_9$	9.47608695652	$-1.34x_{14}$	$-1.28x_{12}$	$+11.29x_2$	$+8.00x_4$	$-0.16x_{13}$
$x_{10}$	17.0826086957	$-1.90x_{14}$	$-1.11x_{12}$	$+6.54x_2$	$+11.63x_4$	$+0.01x_{13}$
$x_{11}$	33.2065217391	$-0.76x_{14}$	$-1.03x_{12}$	$-2.15x_2$	$+9.83x_4$	$-0.23x_{13}$
$x_7$	24.6869565217	$+0.32x_{14}$	$-0.90x_{12}$	$+12.90x_2$	$-10.71x_4$	$+0.82x_{13}$
$x_5$	0.458695652174	$-0.05x_{14}$	$+0.06x_{12}$	$-0.77x_2$	$+0.18x_4$	$-0.00x_{13}$
$x_1$	1.02173913043	$+0.13x_{14}$	$+0.08x_{12}$	$-0.17x_2$	$-0.73x_4$	$+0.05x_{13}$
$z$	2.48260869565	$-0.70x_{14}$	$-0.41x_{12}$	$+2.94x_2$	$+0.93x_4$	$-0.09x_{13}$

## 1 Optimization Phase Simplex

Starting Dictionary is:

$x_6$	24.4565217391	$-0.26x_{14}$	$-0.40x_{12}$	$-6.65x_2$	$-5.29x_4$	$+0.14x_{13}$
$x_3$	2.82608695652	$-0.04x_{14}$	$-0.11x_{12}$	$+0.39x_2$	$+0.33x_4$	$+0.07x_{13}$
$x_8$	37.9043478261	$-1.37x_{14}$	$-0.63x_{12}$	$-10.83x_2$	$+7.50x_4$	$-0.14x_{13}$
$x_9$	9.47608695652	$-1.34x_{14}$	$-1.28x_{12}$	$+11.29x_2$	$+8.00x_4$	$-0.16x_{13}$
$x_{10}$	17.0826086957	$-1.90x_{14}$	$-1.11x_{12}$	$+6.54x_2$	$+11.63x_4$	$+0.01x_{13}$
$x_{11}$	33.2065217391	$-0.76x_{14}$	$-1.03x_{12}$	$-2.15x_2$	$+9.83x_4$	$-0.23x_{13}$
$x_7$	24.6869565217	$+0.32x_{14}$	$-0.90x_{12}$	$+12.90x_2$	$-10.71x_4$	$+0.82x_{13}$
$x_5$	0.458695652174	$-0.05x_{14}$	$+0.06x_{12}$	$-0.77x_2$	$+0.18x_4$	$-0.00x_{13}$
$x_1$	1.02173913043	$+0.13x_{14}$	$+0.08x_{12}$	$-0.17x_2$	$-0.73x_4$	$+0.05x_{13}$
$z$	2.48260869565	$-0.70x_{14}$	$-0.41x_{12}$	$+2.94x_2$	$+0.93x_4$	$-0.09x_{13}$

$x_2$  enters and  $x_5$  leaves

$x_6$	20.4915254237	$+0.15x_{14} - 0.88x_{12} + 8.64x_5 - 6.88x_4 + 0.17x_{13}$
$x_3$	3.0593220339	$-0.07x_{14} - 0.08x_{12} - 0.51x_5 + 0.42x_4 + 0.06x_{13}$
$x_8$	31.4463276836	$-0.70x_{14} - 1.42x_{12} + 14.08x_5 + 4.92x_4 - 0.09x_{13}$
$x_9$	16.2062146893	$-2.05x_{14} - 0.47x_{12} - 14.67x_5 + 10.70x_4 - 0.21x_{13}$
$x_{10}$	20.9802259887	$-2.31x_{14} - 0.64x_{12} - 8.50x_5 + 13.19x_4 - 0.02x_{13}$
$x_{11}$	31.9237288136	$-0.63x_{14} - 1.18x_{12} + 2.80x_5 + 9.32x_4 - 0.22x_{13}$
$x_7$	32.3785310734	$-0.48x_{14} + 0.03x_{12} - 16.77x_5 - 7.63x_4 + 0.76x_{13}$
$x_2$	0.59604519774	$-0.06x_{14} + 0.07x_{12} - 1.30x_5 + 0.24x_4 - 0.00x_{13}$
$x_1$	0.918079096045	$+0.14x_{14} + 0.06x_{12} + 0.23x_5 - 0.77x_4 + 0.06x_{13}$
$z$	4.23446327684	$-0.89x_{14} - 0.20x_{12} - 3.82x_5 + 1.63x_4 - 0.11x_{13}$

$x_4$  enters and  $x_1$  leaves

$x_6$	12.2844036697	$-1.11x_{14} - 1.45x_{12} + 6.62x_5 + 8.94x_1 - 0.32x_{13}$
$x_3$	3.55963302752	$+0.01x_{14} - 0.05x_{12} - 0.39x_5 - 0.54x_1 + 0.09x_{13}$
$x_8$	37.3119266055	$+0.20x_{14} - 1.01x_{12} + 15.52x_5 - 6.39x_1 + 0.26x_{13}$
$x_9$	28.9633027523	$-0.08x_{14} + 0.41x_{12} - 11.53x_5 - 13.90x_1 + 0.56x_{13}$
$x_{10}$	36.7155963303	$+0.11x_{14} + 0.45x_{12} - 4.62x_5 - 17.14x_1 + 0.92x_{13}$
$x_{11}$	43.0366972477	$+1.08x_{14} - 0.41x_{12} + 5.53x_5 - 12.10x_1 + 0.44x_{13}$
$x_7$	23.2752293578	$-1.88x_{14} - 0.60x_{12} - 19.01x_5 + 9.92x_1 + 0.22x_{13}$
$x_2$	0.880733944954	$-0.02x_{14} + 0.09x_{12} - 1.23x_5 - 0.31x_1 + 0.01x_{13}$
$x_4$	1.19266055046	$+0.18x_{14} + 0.08x_{12} + 0.29x_5 - 1.30x_1 + 0.07x_{13}$
$z$	6.18348623853	$-0.59x_{14} - 0.06x_{12} - 3.34x_5 - 2.12x_1 + 0.01x_{13}$

$x_{13}$  enters and  $x_6$  leaves

$x_{13}$	38.0397727273	$-3.44x_{14} - 4.49x_{12} + 20.51x_5 + 27.68x_1 - 3.10x_6$
$x_3$	7.11931818182	$-0.31x_{14} - 0.47x_{12} + 1.53x_5 + 2.05x_1 - 0.29x_6$
$x_8$	47.1534090909	$-0.69x_{14} - 2.17x_{12} + 20.83x_5 + 0.77x_1 - 0.80x_6$
$x_9$	50.1818181818	$-2.00x_{14} - 2.09x_{12} - 0.09x_5 + 1.55x_1 - 1.73x_6$
$x_{10}$	71.8238636364	$-3.06x_{14} - 3.69x_{12} + 14.31x_5 + 8.41x_1 - 2.86x_6$
$x_{11}$	59.8579545455	$-0.44x_{14} - 2.40x_{12} + 14.60x_5 + 0.14x_1 - 1.37x_6$
$x_7$	31.5113636364	$-2.63x_{14} - 1.57x_{12} - 14.57x_5 + 15.91x_1 - 0.67x_6$
$x_2$	1.36931818182	$-0.06x_{14} + 0.03x_{12} - 0.97x_5 + 0.05x_1 - 0.04x_6$
$x_4$	3.91477272727	$-0.06x_{14} - 0.24x_{12} + 1.76x_5 + 0.68x_1 - 0.22x_6$
$z$	6.60227272727	$-0.62x_{14} - 0.11x_{12} - 3.11x_5 - 1.82x_1 - 0.03x_6$

Final Dictionary Solution: 6.60227272727 Num Pivots: 4