Quantitative Management Modeling

Assignment 3 : Weigelt Corporation

1. Solve the problem using lpsolve, or any other equivalent library in R.

   See weigelt_3.R

2. Identify the shadow prices, dual solution, and reduced costs

   Shadow prices:

   0.00 0.00 0.00 12.00 20.00 60.00 0.00 0.00 0.00 -0.08 0.56

   Dual solution:

   0.00 0.00 0.00 12.00 20.00 60.00 0.00 0.00 0.00 -0.08 0.56

   Reduced cost:

   0 0 -24 -40 0 0 -360 -120 0

3. Further, identify the sensitivity of the above prices and costs. That is, specify the range of shadow prices and reduced cost within which the optimal solution will not change.

```
> cbind(get.sensitivity.rhs(lprec)$duals[1:11],
get.sensitivity.rhs(lprec)$dualsfrom[1:11], get.sensitivity.rhs(lprec)$dualstill[1:11])
      price        lower        upper
 [1,]  0.00 -1.000000e+30 1.000000e+30
 [2,]  0.00 -1.000000e+30 1.000000e+30
 [3,]  0.00 -1.000000e+30 1.000000e+30
 [4,] 12.00  1.122222e+04 1.388889e+04
 [5,] 20.00  1.150000e+04 1.250000e+04
 [6,] 60.00  4.800000e+03 5.181818e+03
 [7,]  0.00 -1.000000e+30 1.000000e+30
 [8,]  0.00 -1.000000e+30 1.000000e+30
 [9,]  0.00 -1.000000e+30 1.000000e+30
[10,] -0.08 -2.500000e+04 2.500000e+04
[11,]  0.56 -1.250000e+04 1.250000e+04
```

```
> cbind(get.sensitivity.rhs(lprec)$duals[12:20],
get.sensitivity.rhs(lprec)$dualsfrom[12:20], get.sensitivity.rhs(lprec)$dualstill[12:20])
     cost        lower        upper
 [1,]    0 -1.000000e+30 1.000000e+30
 [2,]    0 -1.000000e+30 1.000000e+30
 [3,]  -24 -2.222222e+02 1.111111e+02
 [4,]  -40 -1.000000e+02 1.000000e+02
 [5,]    0 -1.000000e+30 1.000000e+30
 [6,]    0 -1.000000e+30 1.000000e+30
 [7,] -360 -2.000000e+01 2.500000e+01
 [8,] -120 -4.444444e+01 6.666667e+01
 [9,]    0 -1.000000e+30 1.000000e+30
```

4.

Let

L1 + M1 + S1 <= 750 -----(y1)

L2 + M2 + S2 <= 900 -----(y2)

L3 + M3 + S3 <= 450 -----(y3)

20 L1 + 15 M1 + 12 S1 <= 13000 ----(y4)

20 L2 + 15 M2 + 12 S2 <= 12000 ----(y5)

20 L3 + 15 M3 + 12 S3 <= 5000 -----(y6)

L1 + L2 + L3 <= 900 -----(y7)

M1 + M2 + M3 <= 1200 -----(y8)

S1 + S2 + S3 <= 750 -----(y9)

900 L1 + 900 M1 + 900 S1 - 750 L2 - 750 M2 - 750 S2 = 0 ----(y10)

450 L1 + 450 M1 + 450 S1 - 750 L3 - 750 M3 - 750 S3 = 0 ----(y11)

Objective Function:

Min Z: +750 y1 + 900 y2 + 450 y3 + 13000 y4 + 12000 y5 + 5000 y6 + 900 y7 + 1200 y8 + 750 y9

+ 0 y10 + 0 y11;

Constraints:

Subject to:

y1 + 20 y4 + y7 + 900 y10 + 450 y11 >= 420;

y1 + 15 y4 + y8 + 900 y10 + 450 y11 >= 360;

y1 + 12 y4 + y9 + 900 y10 + 450 y11 >= 300;

y2 + 20 y5 + y7 - 750 y10 >= 420;

y2 + 15 y5 + y8 - 750 y10 >= 360;

y2 + 12 y5 + y9 - 750 y10 >= 300;

y3 + 20 y6 + y7 - 750 y11 >= 420;

y3 + 15 y6 + y8 - 750 y11 >= 360;

y3 + 12 y6 + y9 - 750 y11 >= 300;

non-negativity

y1, y2, y3, y4, y5, y6, y7, y8, y9 >= 0

y10, y11 = unrestricted

The solution agrees with the Primal problem. The dual problem LP and R file has been attached.