

Reading the sensitivity report on Excel (Duality.xlsx)

Microsoft Excel 16.0 Sensitivity Report
 Worksheet: [Duality.xlsx]Primal - 2
 Report Created: 12/2/2019 3:44:29 PM

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$B\$2	Decision Variables x1	12	0	550	50	50
\$C\$2	Decision Variables x2	7.2	0	600	83.333333333	50
\$D\$2	Decision Variables x3	0	-125	350	125	1E+30
\$E\$2	Decision Variables x4	0	-231.25	400	231.25	1E+30
\$F\$2	Decision Variables x5	0	-368.75	200	368.75	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$G\$6	Grinding	288	6.25	288	96	57.6
\$G\$7	Drilling	177.6	0	192	1E+30	14.4
\$G\$8	Manpower	384	23.75	384	22.15384615	96

Reduced Cost

Products 3, 4, and 5 are too cheap compared to the required effort. For item 3, if the objective function coefficient (price) was $350 - (-125) = 475$, we would start to produce this item.

For item 4, this is $400 - (-231.25) = 631.25$.

5 $200 - (-368.75) = 568.75$.

For x_1 and x_2 , the reduced cost is 0, as they are already being produced. For product 1, if the price is in the allowable range, i.e. $[500, 600]$, then the optimal solution does not change. For example, if the price of product 1 was ~~540~~ instead of 550, we would still produce 12 product 1 and 7.2 product 2. Our revenue would be $(550 - 540) \cdot 12 = 120$ lower, but this solution would still be optimal.

For product 2 this range is $[600 - 50, 600 + 83.3] = [550, 683.3]$.

Shadow Prices

Shadow price for grinding constraint is 6.25. One unit of change in the right hand side of this constraint changes the optimal objective function value by 6.25\$. This change is only valid in the allowable range, i.e. $[288 - 57.6, 288 + 96] = [230.4, 384]$. For example, if the grinding capacity increases by 2 units ($\rightarrow 288 + 2 = 290$), then the objective function increases by $2 \cdot 6.25 = 12.5$ \$. If it decreases by 10 units to 278, then the optimal objective function value decreases by 62.5 \$. In both cases the values of the decision variables change.

The shadow price for drilling is 0. As you have spare capacity for drilling, you would not pay anything to acquire extra drilling capacity.

One unit of manpower is worth 23.75\$ ~~*~~ in the allowable range $[384 - 96, 384 + 22.15] = [288, 406.15]$. If we increase the manpower capacity to ~~450~~ 450, which is outside of the allowable range, we have to solve the problem again to find the optimal solution.