Assignment 5

Due Monday, Oct. 23

These questions are to be answered as much as possible with the techniques of sensitivity analysis, using the given optimal tableau or the LINDO output for the original problem. When it asks for the optimal solution, find the values of the variables and the objective.

6.3.3, 6.3.6, 6.3.8, 6.3.9, 6.4.7, 6.4.13

Note for 6.3.8: we would rewrite the problem as

$$\begin{array}{lll} \text{maximize} & z = -50\,x_1 - 100\,x_2 & \\ \text{subject to} & -7\,x_1 - 2\,x_2 & \le -28 \\ & -2\,x_1 - 12\,x_2 & \le -24 \\ & x_1, x_2 \ge 0 & \end{array}$$

and then the optimal tableau in our format would be

z	x_1	x_2	s_1	s_2	rhs		
1	0	0	5	7.5	−320	=	z
0	1	0	−.15	.025	3.6	=	x_1
0	0	1	.025	−.0875	1.4	=	x_2

E.1. Consider the linear programming problem

$$\begin{array}{lll} \text{maximize} & z = -x_1 + 4\,x_2 + 7\,x_3 + 10\,x_4 & \\ \text{subject to} & 3\,x_1 + 8\,x_2 + x_3 + 2\,x_4 & \le 15 \\ & 3\,x_1 + 12\,x_2 - 3\,x_3 - 3\,x_4 & = 18 \\ & \quad 4\,x_2 + 4\,x_3 + 8\,x_4 & \le 4 \\ & x_1, x_2, x_3, x_4 \ge 0 & \end{array}$$

It turns out that the optimal solution has basis x_1, s_1 and x_2 with

$$B^{-1} = \begin{pmatrix} 0 & 1/3 & -1 \\ 1 & -1 & 1 \\ 0 & 0 & 1/4 \end{pmatrix}$$

(a) Find the optimal solution, the dual prices and the reduced costs.

(b) Suppose a new variable x_5 is introduced, which enters into the objective with coefficient 3 and into the constraints with coefficients 1, 3 and p respectively. For what values of p would the solution above, with $x_5 = 0$, still be optimal? Taking a value of p that makes this solution optimal but not the only optimal solution, what would be another optimal basic solution?