Sensitivity Analysis via LINDO

Consider again the LP model of **PAR, Inc**., which manufactures standard and deluxe golf bags:

X1 = number of STANDARD golf bags manufactured per quarter

X2 = number of DELUXE golf bags manufactured per quarter

Four operations are required, with the time per golf bag as follows:

	Standard	Deluxe	Available
Cut-&-Dye	0.7 hr	1.0 hr	630 hrs
Sew	0.5 hr	0.8666 hr	600 hrs
Finish	1.0 hr	0.6666 hr	708 hrs
Inspect-&-Pack	0.1 hr	0.25 hr	135 hrs
Profit ($/bag)	10.00	9.00	

LINDO provides the following output:

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MAX     10 X1 + 9 X2
 SUBJECT TO
       2)   0.7 X1 + X2 <=   630
       3)   0.5 X1 + 0.86666 X2 <=   600
       4)   X1 + 0.66666 X2 <=   708
       5)   0.1 X1 + 0.25 X2 <=   135
 END
       OBJECTIVE FUNCTION VALUE
       1)    7668.01200

  VARIABLE        VALUE          REDUCED COST
       X1       540.003110          .000000
       X2       251.997800          .000000

      ROW   SLACK OR SURPLUS     DUAL PRICES
       2)          .000000         4.375086
       3)       111.602000          .000000
       4)          .000000         6.937440
       5)        18.000232          .000000

RANGES IN WHICH THE BASIS IS UNCHANGED:

                        OBJ COEFFICIENT RANGES
 VARIABLE         CURRENT        ALLOWABLE        ALLOWABLE
                   COEF          INCREASE         DECREASE
       X1       10.000000         3.500135         3.700000
       X2        9.000000         5.285715         2.333400

                      RIGHTHAND SIDE RANGES

      ROW         CURRENT        ALLOWABLE        ALLOWABLE
                    RHS          INCREASE         DECREASE
        2      630.000000        52.364582       134.400000
        3      600.000000          INFINITY      111.602000
        4      708.000000       192.000010       128.002800
        5      135.000000          INFINITY       18.000232
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THE TABLEAU

ROW (BASIS)	X1	X2	SLK 2	SLK 3	SLK 4	SLK 5	
1 ART	.00	.00	4.375	.00	6.937	.00	7668.012
2 X2	.00	1.00	1.875	.00	-1.312	.00	251.998
3 SLK 3	.00	.00	-1.000	1.00	.200	.00	111.602
4 X1	1.00	.00	-1.250	.00	1.875	.00	540.003
5 SLK 5	.00	.00	-.344	.00	.141	1.00	18.000

Enter the correct answer into each blank or check the correct alternative answer, as appropriate. If not sufficient information, write "NSI" in the blank:

a. If the profit on DELUXE bags were to decrease from $9 each to $7 each, the number of DELUXE bags to be produced would
|__| increase |__| decrease |__| remain the same |__| not sufficient info.

b. The LP problem above has
|__| exactly one optimal solution |__| exactly two optimal solutions
|__| an infinite number of optimal solutions

c. If an additional 10 hours were available in the sewing department, PAR would be able to obtain an additional $_____ in profits.

d. If an additional 10 hours were available in the finishing department, PAR would be able to obtain an additional $_____ in profits.

e. If PAR is forced to increase the variable "SLK 4" by 1 hour (equivalently, to reduce the time available in the finishing department by 1 hour), this will have the effect(s) of
|__| increasing |__| decreasing the hours used in the cut-&-dye department
|__| increasing |__| decreasing the hours used in the sewing department

f. If the variable "SLK 4" were increased by 10, X1 would |__| increase |__| decrease by _____ STANDARD golf bags/quarter.

g. If the variable "SLK 4" were increased by 10, X2 would |__| increase |__| decrease by _____ DELUXE golf bags/quarter.

h. If a pivot were to be performed to enter the variable SLK4 into the basis, then according to the "minimum ratio test", the value of SLK4 in the resulting basic solution would be approximately
|__| $^{252}/_{1.312}$ |__| $^{0.2}/_{111.6}$ |__| $^{540}/_{1.875}$ |__| $^{0.141}/_{18}$
|__| $^{1.312}/_{252}$ |__| $^{111.6}/_{0.2}$ |__| $^{1.875}/_{540}$ |__| $^{18}/_{0.141}$
|__| insufficient information available

i. If the variable SLK 4 were to enter the basis, then the variable _____ will leave the basis.

********* *Solutions* *********

a. If the profit on DELUXE bags were to decrease from $9 each to $7 each, the number of DELUXE bags to be produced would

|__| increase |__| decrease |_**X**_| remain the same |__| not sufficient info.

b. The LP problem above has

|_**X**_| exactly one optimal solution |__| exactly two optimal solutions

|__| an infinite number of optimal solutions

c. If an additional 10 hours were available in the sewing department, PAR would be able to obtain an additional $___**zero**_____ in profits.

d. If an additional 10 hours were available in the finishing department, PAR would be able to obtain an additional $___**69.37**_____ in profits.

e. If PAR is forced to increase the variable "SLK 4" by 1 hour (equivalently, to reduce the time available in the finishing department by 1 hour), this will have the effect(s) of

|__| increasing |__| decreasing the hours used in the cut-&-dye department

|__| increasing |_X| decreasing the hours used in the sewing department

f. If the variable "SLK 4" were increased by 10, X1 would |__| increase |_**X**_| decrease by _**18.75**___ STANDARD golf bags/quarter.

g. If the variable "SLK 4" were increased by 10, X2 would |_**X**_| increase |__| decrease by __**13.12**__ DELUXE golf bags/quarter.

h. If a pivot were to be performed to enter the variable SLK4 into the basis, then according to the "minimum ratio test", the value of SLK4 in the resulting basic solution would be approximately

|___| $^{252}/_{1.312}$ |___| $^{0.2}/_{111.6}$ |___| $^{540}/_{1.875}$ |___| $^{0.141}/_{18}$

|___| $^{1.312}/_{252}$ |___| $^{111.6}/_{0.2}$ |___| $^{1.875}/_{540}$ |_X| $^{18}/_{0.141}$

|__| insufficient information available

i. If the variable SLK 4 were to enter the basis, then the variable _**SLK5**_ will leave the basis.