Sensitivity analysis

Sensitivity analysis investigates the change in the optimum solution resulting from making changes in parameters of the LP model. The following table lists all possible cases that can arise in sensitivity analysis together with the actions needed to obtain the new solution (assuming it exists):

Condition resulting from the changes	**Recommended action**
Current solution remains optimal and feasible.	No further action is necessary
Current solution becomes infeasible.	Use dual simplex to recover feasibility
Current solution becomes nonoptimal	Use primal simplex to recover optimality
Current solution becomes both nonoptimal and infeasible	Use the generalized simplex method to obtain a new solution

Example:

Primal Problem

$$Max\, z = 3x_1 + 2x_2 + 5x_3$$

$$\begin{aligned} Subject\, to \quad & x_1 + 2x_2 + x_3 \le 430 \\ & 3x_1 \quad + 2x_3 \le 460 \\ & x_1 \quad + 4x_2 \le 420 \end{aligned}$$

Changing the right hand

The changes require recomputing the right hand sides of the table.

$$(New\ r.h.s.Values) = (Inversematrix)(\text{Pr}esent\ availability)$$

a) Suppose operation 1,2,3 increased by 40% then calculate optimal solution.
b) Suppose operation 1,2 and 3 are 450,460,400 .
c) Suppose operation 1 changed by amount D_1.

Eg 1. A Company manufactures purses, shaving bags, and backpacks. The construction of the three products requires lather and synthetic material, with leather being the limiting raw material. The production process uses two types of skilled labor: sewing and finishing. The following table gives the availability of the resources, their usage of the three products, and the profits per unit.

Resource requirements per unit				
Resource	Purse	Bag	Backpack	Daily availability
Leather (ft^2)	2	1	3	42
Sewinq(hr)	2	1	2	40
Finishina (hr)	1	5	1	45
Profit ($)	24	22	45	

Formulate the problem as a linear program and find the optimum solution. Next, indicate whether the following changes in the resources will keep the current solution feasible. For the cases where feasibility

is minted, determine the new optimum solution (values of the variables and the objective function).

(a) Available leather is increased to 45 ft2.
(b) Available leather is decreased by 1ft2.
(c) Available sewing hours are changed to 38 hours.
(d) Available sewing hours are changed to 46 hours.
(e) Available finishing h.ours are decreased to 15 hours.
(f) Available finishing ours are increased to 50 hours.

2. A company produces two models of electronic gadgets that resistors, capacitors, and chips. The following table summarizes the data of the situation:

Unit resource			
Resource	Model 1 (units)	Model 2 (units)	Maximum availability (units)
Resistor	2	3	1200
Capacitor	2	1	1000
Chips	0	4	800
Unit profit ($)	3	4	

Let x_1 and x_2 be the amounts produced of Models 1 and 2, respectively. Following are the LP model and its associated optimal simplex tableau.

$$Max\, z = 3x_1 + 4x_2$$
$$Subject\, to \quad 2x_1 + 3x_2 \le 1200$$
$$2x_1 + x_2 \le 1000$$
$$4x_2 \le 800$$

a) Determine the status of each resource.
b) If the available number of resistors increased to 1300units, find new optimum solution.
c) If the available number of chips reduced to 350 units, will u able to determine the new optimum solution directly from the given information?
d) A new contractor is offering to sell additional resistors at 40 cents each but only if the company would purchase at least 500 units. Should you accept the offer?