

Emne TIØ4120 Operasjonsanalyse, grunnkurs

Øving 4

Utlevering: mandag 09.09

Veiledning: fredag 13.09 14:15–16:00 i EL2

Innlevering: onsdag 18.09 på Blackboard

Oppgave 1

The well known company MicroCorp produces three different types of soft products, Small, Medium and Xel. For each product it sells on the market the company makes a certain profit. Since its products are not very sophisticated only two resources are needed for production.

The production planning problem of the company can be written as follows:

$$\text{Max } z = 5x_1 + 3x_2 + x_3$$

s.t.

$$x_1 + x_2 + 3x_3 \leq 6$$

$$5x_1 + 3x_2 + 6x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0$$

- Solve the given LP-problem to optimality with the Simplex method. Carry out at least two iterations (initial tableau plus two iterations).
 Why is your solution optimal?
 Hint: You should reach optimality in less than 5 iterations.
- Is there anything special about your solution?
- While the production department is completely satisfied with your solution, the sales department is not sure if your proposal is wise from a marketing point of view. Can you suggest any other solutions the marketing department could choose from?
- Report the dual variable values of your solution. What do they mean?

Consider the following partial information from the sensitivity report:

Adjustable Cells				
Cell	Name	Objective Coefficient	Allowable Increase	Allowable Decrease
	x1	5	1E+30	0
	x2	3	0	1E+30
	x3	1	5	1E+30

Constraints				
Cell	Name	Constraint R.H. Side	Allowable Increase	Allowable Decrease
	resource 1	6	1E+30	3
	resource 2	15	15	15

- e) Due to bankruptcy of the competitor "Orange" 15 more units of resource 2 (second constraint) will become available very cheap. How do the objective function value and the production plan change if the resource availability could be increased by 15 units? (Say as much as you can based on the information you have.)
What changes if the second resource is increased to 31?
- f) The sales department has decided that the maximum price for product 3 that can be charged to the customers is 3. How do the objective function value and the production plan change? (Use the information you have; do not re-solve the problem.)

Oppgave 2

Given a primal (P) and dual problem (D)

$$\begin{array}{ll}
 (P) \min z = 3x_1 - x_2 + Ax_3 & (D) \max w = 10v_1 - v_2 + 5v_3 \\
 \text{s.t.} & \text{s.t.} \\
 2x_1 + x_2 + x_3 \leq 10 & 2v_1 - 5v_2 \leq 3 \\
 Cx_1 + x_3 \geq -1 & v_1 + v_3 \leq -1 \\
 x_2 + 2x_3 \leq B & v_1 + v_2 + 2v_3 \geq D \\
 x_1, x_2 \geq 0 & v_1 \leq 0 \\
 x_3 \leq 0 & v_2 \geq 0 \\
 & v_3 \leq E
 \end{array}$$

Determine the value or sign of the parameters A , B , C , D , and E . Use the fact that the optimal primal and dual solutions are $x = (0 \ 11 \ -1)$ and $v = (-1 \ 8 \ 0)$, respectively.

Oppgave 3

Formulate the dual of the following problem

$$\begin{array}{ll}
 \max z = x_1 + 2x_2 + x_3 + x_4 & \\
 \text{s.t.} & \\
 2x_1 + x_2 + 5x_3 + x_4 \leq 8 & (1) \\
 2x_1 + 2x_2 + 4x_4 = 12 & (2) \\
 3x_1 + x_2 + 2x_3 \geq 18 & (3) \\
 x_1, x_2, x_4 \geq 0 & \\
 x_3 \leq 0 &
 \end{array}$$

Oppgave 4

Study the problem

$$\begin{array}{ll} \min & z = 2x_1 + 2x_2 + x_3 - x_4 + x_5 \\ \text{s.t} & x_1 + 2x_2 - x_3 + 2x_4 = 6 \\ & 2x_1 + x_3 + x_5 \geq 4 \\ & 3x_2 - 2x_3 + 3x_4 = 7 \\ & x_1, x_2, x_3, x_4, x_5 \geq 0 \end{array}$$

Assume the dual solution $v = (1 \ 0 \ -1)$.

- Determine if the dual solution is feasible.
- State the corresponding primal solution and determine if it is feasible.
- Is the given dual solution optimal?