Technische Universität Berlin
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Mathematical Tools for Engineering and Management
Winter Term 2011/2012

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Exercise sheet 11

Exercise 2 is the last graded homework of this course. The due date is February 1, 2012.

Exercise 1

Consider the following nonlinear optimization problem: min $\sqrt{(x-14)^2+(y-14)^2}$ subject to

$$\begin{array}{rcl} (x-8)^2+(y-9)^2 & \leq & 49 \\ x & \geq & 2 \\ x & \leq & 13 \\ x+y & \leq & 24 \end{array}$$

1. Plot the feasible region in the interval $[0,16]^2$.
2. Plot the isoquant lines of the objective function.
3. Give an optimal solution and its objective function value.
4. What happens if the object function is changed to max $\sqrt{(x-14)^2+(y-14)^2}$?
5. What if it is changed to min $\sqrt{(x-8)^2+(y-8)^2}$?

Graded Homework

Exercise 2

Health& Comfort, Incorporated(H&C) specializes in the production of hypoallergenic pillow and mattress covers for asthma and allergy sufferers. The covers are made out of a unique protective fabric. The manufacturing process consists mainly of two operations: cutting and sewing, which are performed by to separate departments. Figure 1 shows the resource utilization and weekly resource availability for this problem.

	Pillow Cover	Mattress Cover	Availability per Week
Fabric(square feet)	8.75	60.5	40000
Cutting (hours)	0.1	0.2	150
Sewing (hours)	0.4	0.3	500

Figure 1: Resources

H&C is one of the largest producers of hypoallergenic bedding, and it controls a large share of the market. As a consequence, the production level of each product at H&C influences the market price of the product, which in turn influences their unit earnings contribution. Econometric research indicated that this dependence can be represented as

$$E_P = 506 - 0.75P$$

for pillow covers, and

$$E_M = 653.5 - M$$

for mattress covers (here P and M are the production levels of the pillow and mattress covers at H&C, and E_p and E_M are the corresponding unit contributions to earnings in dollar per unit. H&C is seeking to maximize its earnings by selecting appropriate production levels of its products.

1. Formulate a nonlinear optimization model of production for H&C in terms of the variables P, M, E_P and E_M. Your model should have linear constraints and a nonlinear objective function. [6 points]
2. Solve your model using AIMMS. [8 points]