

Exam test – Operation Research

1. **(4 points)** Formulate the linear optimization model for the following problem. Explain the meaning of variables.

KUP TO Company needs to decide how many summer caps and scarfs should to order for the following summer. It is known that the profit from each summer cap is 80 CzK and from each scarf is 60 CzK. It is also known from last years that they sell at least sell a hundred pieces of more scarfs than caps.; and at least one hundred of scarfs. How many caps and scarfs should the company order if they want to maximize its profit. There budget for caps and scarfs is 50 000 CzK and the order price of a scarf is 100 CzK and of a smmur cap 120 CzK.

2. **(1 point)** (Question to the previous example.) Is it possible to estimate (with the solution of the problem) the optimal number of caps and scarfs. Explain your answer.

3. **(4+5 points)** Use the graphical solution to solve the following problem. Then solve this problem by using SW. The sensitive analysis upload to the Moodle.

$$\begin{aligned} &\min 4x_1 + x_2 \\ &\text{s. t. } 2x_1 + 2x_2 \geq 8, \\ &\quad 3x_1 + 2x_2 \leq 18, \\ &\quad x_1 - x_2 \geq 0, \\ &\quad x_1, x_2 \geq 0. \end{aligned}$$

4. **(3 points)** Draw the precedence diagram for the following problem, apply Critical Path Method to compute the duration of the project.

activity	prec.	duration
a		2
b		5
c	b	1
d	a	10
e	a,b	3
f	e,d	7

5. **(2 points)** (Question to the previous example.) Is it possible to finish the project early than is the duration of the project obtained by CPM? In not, explain why not. If yes, explain what do you need to know to do it.
6. **(1 point)** Let us suppose that the duration of the activity a in normal setting is 11 days and cost 2, however this activity can be crash to the duration only one day and then the cost is 12. Estimate the cost on this activity if it takes 8, resp. 11 days.