

Exam test OR

1. **(6 points)** Formulate a mathematical model of the following economical problem. Explain what the variables means.

KUP TO company needs to decide how many summer caps and how many scarfs should order for following summer. They know that the profit from each summer cap is 50 CzK and from each scarf 60 CzK. It is known (from previous years) that they usually sell at least three time more caps than scarfs and usually they sell at least one hundred scarfs. What is the optimal order in case that the company wants to maximize its profit and has 50 000 CzK for using? The ordering price of a cap is 120 CzK and of a scarf is 100 CzK.

2. **(2 points)** (Question to the previous example.) Is it possible to estimate the solution (what is the optimal number of caps and scarfs) of the previous example (do not solve it!). Explain your answer.

3. **(3+3 points)** Use a software and solve the following example. Find the optimal solution and save the sensitive analysis to the Moodle system. Check your solution in graphical way.

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

4. **(3 points)** Draw a graph for the following project and apply CPM method.

activity	predecessors	duration
a		2
b		5
c	a	10
d	b	1
e	a,b	3
f	e,d	4

5. **(3 points)** Is it possible to finish the project in shorter time than is the solution of CPM. If yes, under which conditions? What do you need to know to make a decision. If not, why?
6. **(2 points)** Let us suppose that the normal duration of an activity a is sixt days and it is possible to crash it into one day. Normal cost is 2 and in case of duration only 1 day the cost is 12. Estimate cost in case of duration 4 and 6 days.
7. **(8 points (4+4))** Let us suppose that the company has four branches. Each of tha branches is characterized by two inputs and 1 output. Identify the effective units. Use graphical solution. Then, write down the mathematical model for the second unit.

unit	input 1	input 2	output
D1	8	24	8
D2	15	30	5
D3	10	12	4
D4	8	4	2