Zkouškový test – Operační analýza

1. **(4 body)** Formulate a mathematical model and explain the variables.

   Mrs. Vokurkova from Tomato comp. plans a holiday, she will flight to Split. She would like to earn some money also during her holiday, so she plan to take with her some food to sell it to her colleagues. She considers taking of bricks of cheese (2.5 kg, planned profit 80 *CzK), salami cones (2 kg, planned profit* 90 *CzK), instant coffee packages (1 kg, planned profit* 30 *CzK), or concentrated juice packages (1 kg, planned profit* 25 *CzK). She plans to have maximally 5 kg of her own stuff and limit for transportation is 25 kg. She knows that she needs at least twice as much juice concentrate as instant coffee and at least two more kg of cheese than salami. She wants to earn at least* 400 *CzK and to have the lighten luggage as much as is possible.*

2. **(4 +4 body)** Solve the following problem in a graphical way. Highlight the set of feasible solutions and all optimal solutions. Then use SW to solve the problem and solution upload to Moodle system.

$$\begin{aligned} \max\, & 3x_1 + x_2 \\ \text{s. t. } & 2x_1 + x_2 \leq 10, \\ & 2x_1 + 3x_2 \geq 6, \\ & x_2 - 2x_1 \geq 0, \\ & x_1,\ x_2 \geq 0. \end{aligned}$$

3. **(4 body)** ALEA comp. needs to finish the following project within 12 months. The project has 4 activities – A,B,C,D, for more details see bellow. Project manager found out that it is not possible to finish the project in deadline without crashing. What is the cheapest way how to finich the project on time?

Activity	Pred.	Normal time	The shortest time	Normal cost	Cost after crashing
A		8 months	5 months	$ 25,000	$ 40,000
B		9 months	7 months	$ 20,000	$ 30,000
C	A	6 months	4 months	$ 16,000	$ 24,000
D	B	7 months	4 months	$ 27,000	$ 45,000

4. **(1 bod)** What is the main difference between input- and output-oriented CCR model (when do you chose which one)?

5. **(3 body)** Mr. Skautik is going to buy a tent. He is interested in the following four criteria: weight, thermal comfort, price and material. He decided to apply Saaty methods for construction of weights and constructed the following matrix.

$$\begin{pmatrix} 1 & 1/5 & 1/2 & 1/9 \\ 5 & 1 & 3 & 1/2 \\ 2 & 1/3 & 1 & 1/6 \\ 9 & 2 & 6 & 1 \end{pmatrix}$$

Is it Saaty matrix (explain)? What criterion is the most important for Mr. Skautik? Is the matrix fully consistent? If it is, compute the weights. If it is not, it is possible to get the weights? How?