Exam Test – OR

1. **(4 points)** Construct the mathematical model of the following problem. Explain the variables of the model.

   Mrs. Vokorkova needs to paint her canteen. She needs at least 30 kg of colour. To save some money, she decided to mix the colours from three raw materials alone. How much of materials she should to buy, if there are three raw materials which she wants to use – material M1, material M2, material M3. She consider to mix two types of colours – Type 1 and Type 2. She needs at least 2 kg of type 1 (washable colour). Consumption of raw materials for types of colours and their prices are given in the table. How should Mrs. Vokurkova to mix the colours if she wants to minimize cost?

Colour	M1 per kg of colour (kg)	M2 (kg)	M3 (kg)
Colour 1	0,6	0,2	0,2
Colour 2	0,2	0,3	0,5
Colour 3	0,3	0,4	0,3
náklady (Kč/kg)	70	40	50

2. **(4 points)** Solve the following problem in graphical way. Find out the set of feasible solutions, all basic feasible solutions, and all optimal solutions.

$$\begin{aligned} &\max 2x_1 + x_2 \\ &\text{s.t. } 2x_1 + 2x_2 \geq 6, \\ &3x_1 + 2x_2 \leq 9, \\ &x_2 - 3x_1 \geq 0, \\ &x_1, x_2 \geq 0. \end{aligned}$$

3. **(4 poits)** Develop Gannt diagram for the following project. Decide how many of employees you need to finish the project in time.

activity	pred.	number of employees	time
a		5	1
b		3	3
c	b	2	10
d	a	4	5
e	a,b	3	2
f	c,d	5	4

4. **8 points (4 + 4points)** A supplier of animal feed has five warehouses at five different places. Each warehouse is characterise by two inputs (monthly costs and number of customers) and by one output(monthly profit), see the following table. Decide which warehouses are effective. The problem solve in graphical way, first. Then write down the liear optimization model and explain the variables.

	employees	costs	profits
S1	10	15	10
S2	10	5	5
S3	15	37,5	15
S4	5	10	5
S5	15	15	10