

# KO: Theoretical Test 1

March 16, 2021

## **1 Rules**

- Solve two problems given on the following pages by yourself.
- Use a blank sheet of paper for your answers and do not forget to put your name on the top corner.
- You can ask for clarifications regarding the problem statement via Teams in the designated channel.
- We would like to remind you that you are not allowed to use any materials or the Internet.
- Scan/take a photo of your solution and submit it via BRUTE.

# Branch and Bound Method for ILP

Solve the following ILP instance by Branch and Bound Algorithm, where each vertex of the search tree represents one LP problem (use graphical method to find the solution of such LP).

$$\begin{aligned} \max z = & \quad x_1 + 2x_2 \\ \text{s.t.} \quad & \quad x_1 + x_2 \leq 3 \\ & \quad -2x_1 + 2x_2 \leq 1 \\ & \quad x_1, x_2 \in \mathbb{Z}_0^+ \end{aligned}$$

# 4-Partition Problem

Formulate using ILP:

- ▶ **Instance:** Number of banknotes  $n \in \mathbb{Z}^+$  and their values  $p_1, \dots, p_n$ , where  $p_{i \in 1..n} \in \mathbb{Z}^+$ .
- ▶ **Decision:** Is there any division in 4 pairwise disjoint sets  $S_1, S_2, S_3, S_4$  such that the difference between the highest value of the set and the lowest value of the set is equal or less than 10% of the sum of all banknotes value? Value of the set  $S_j \subseteq \{1, \dots, 4\}$  is given as  $h_j = \sum_{i \in S_j} p_i$ .