



Algorithms and Datastructures

Winter Term 2024

Exercise Sheet 0

Due: Wednesday, October 30th, 12 pm

Exercise 1: Registration

(5 Points)

Register for [Zulip](#) using the invitation-link given on the website. Note that we use Zulip as **forum** for questions regarding the *lecture* and the *exercises* as well as the platform to hand in submissions to tutors.

Exercise 2: Comparing the efficiency of an algorithm

(5 Points)

Suppose that we have two different algorithms \mathcal{A}_1 and \mathcal{A}_2 for solving our problem. For problem inputs of size n , \mathcal{A}_1 takes time:

$$t_1(n) = 10000 + 20 \cdot (\log(n))^2$$

The second algorithm \mathcal{A}_2 takes time:

$$t_2(n) = 2 \cdot \sqrt{n}$$

Which algorithm is faster for inputs of size $n = 1024 = 2^{10}$? For which n do the two algorithms run at the same speed (use a software like wolframalpha)? What happens if n becomes larger? Which algorithm would you choose to implement?

Exercise 3: Small Riddles

(10 Points)

These small riddles can illustrate the types of thought processes one has to think about when designing algorithms. Often finding the best algorithm requires some nice idea or some out of the box thinking. The following two riddles are trying to illustrate what kind of thought processes or argumentations we are looking for in this course.

- Suppose that you have 27 metal balls that all look perfectly identical, but you know that exactly one of them is slightly heavier. The only thing at your disposal is a classical weighing scale. Everytime you weigh some balls against some other balls, either the scale tips left, right or stays balanced. The goal is to find the heaviest ball with the minimum number of uses of the scale. Can you find a way to figure out the heavier ball when weighing just 3 times?



- Suppose a standard 8×8 chessboard (or checkerboard) has two diagonally opposite corners removed, leaving 62 squares. Is it possible to place 31 dominoes of size 2×1 so as to cover all of these squares? Compare Figure 1 for an illustration.

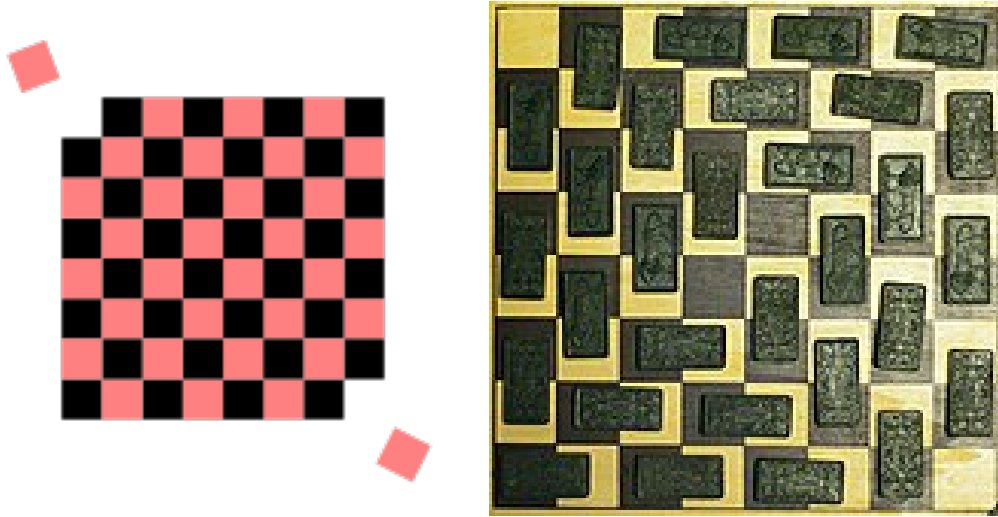


Figure 1: The left side shows a chessboard without the two diagonally opposite corners. The right side shows an (unsuccessful) attempt at a solution.

Exercise 4: Submission

(5 Points)

Send your answers to your tutor, on Zulip to receive feedback. Also if you have any questions regarding this exercise sheets, like a specific question about the riddles, then ask them in a public stream on Zulip.