• Write the name, group number and enrollment number of each group member on every sheet that you hand in.
• To achieve the permission for the exam you must earn 50\% of the sum of all points and present one of your solutions at least once.

Exercise 1
(4 points)
Show that there is no competitive online algorithm for the disjoint path allocation problem.

Exercise 2
(4 points)
Show the existance of an algorithm $CLin2$ that improves the bound from slide 10:16 from $n - 1$ to $n - 2$.
Hint: Distinguish the instances depending on how many isolated vertices they contain.

Exercise 3
(4 points)
Improve the bound of the theorem from slide 9:53 by increasing the sets within $S$.

Exercise 4
(6 points)
The friend of the cow suggests a new game, that he thought of. He gives the cow a set of equally long sticks which should be placed one after another and with the center point on a line with a $45^\circ$ turn. The friend assigns to each stick a number as soon as they are placed. If a stick crosses another one the sticks are not allowed to have the same number. The cow knows that her friend will always choose the smallest possible number for the sticks. So, from the viewpoint of the players which look at the line, the sticks are arranged from top left to bottom right or from bottom left to top right. Two arbitrary sticks are either parallel or orthogonal to each other. An example is presented in the Figure below.

The friend asks if the cow is able to place the sticks in a way such that the highest assigned number is $\kappa$, which will be even. As a cow, she does the obvious: She counts the given sticks. Which number is necessary to win? Obviously this number should depend on $\kappa$.

Figure 1: The dashed line is the center line. There are three sticks placed. Two of them are crossing such that one of them needs a different number.

Bonus presentation exercises: Write your tutor (fischer@cs.rwth-aachen.de or tarik.viehmann@rwth-aachen.de) a mail and announce that you would like to present a presentation exercise. For every exercise group, only one student is allowed to present an exercise. So, write in your mail which exercise you would like to present and your group number. You are allowed to use the whiteboard and the slides from the lecture.

Bonus Exercise 5
(4 points (bonus))
Introduction and lower bound for the String Guessing Problem with unknown history.
Slides: 9:9 to 9:18 (Handout)

Bonus Exercise 6
(4 points (bonus))
Lower Bound for the String Guessing Problem with known history.
Slides: 9:19 to 9:36 (Handout)
<table>
<thead>
<tr>
<th>Exercise</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Bonus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

**Deadline**: The solutions are to be handed in until **July 03, 17:45**, in the lecture or at the drop boxes at the Chair i1.