• You have eight days to create a solution and it must be done in a group of two or three students.
• Write the name and enrolment number of each group member on every sheet that you hand in.
• To get the permission for the oral exam, you must present at least one exercise and achieve 50% of the points.
• You can earn bonus points by presenting your solution. At the beginning of every exercise session, you can mark the exercises that you want to present.
• If a student is not able to present a correct solution although he/she marked the exercise as presentable, he/she will lose all of his/her points on the exercise sheet (except for presentation exercises).
• If you want to prepare an optional presentation exercises to earn bonus points, communicate as soon as possible with your Tutor because only one student can present this type of exercise. You must hold a short presentation about an important proof of the lecture and are allowed to use the slides of the lecture.

Exercise 1 (4 points)
Show that, as mentioned in the lecture, a graph $G$ has modified search number $k + 1$ iff its tree width is $k$. For the $\Rightarrow$ direction, it is enough to describe informally how a tree decomposition can be derived from a pursuit strategy, and why it fits the definition.

Exercise 2 (2 points)
How must the pursuit-evasion-game from the above exercise be modified to make the number of policemen needed correspond to the path width instead of the tree width of a graph? Explain why.

Exercise 3 (2 points)
Define a new graph property similar to pathwidth and treewidth: Cyclewidth. Explain your definition with a short example.

Exercise 4 (4 points)
Cactus graphs are outerplanar graphs where every edge is at most part of one cycle. In other words, every edge is part of the outer window.
Some example cactus graphs are a cycle, a graph that consists of two cycles from which one starts and ends at one vertex of the other one and a graph that consists of two cycles that are connected by a path.
What is the cyclewidth of a cactus graph?

Exercise 5 (4* points)
Optional presentation exercise: Present the proof of Vizings theorem from slide 2:23 to 2:29.