• 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.
• You can earn 50% bonus points by presenting your solution. At the beginning of every exercise session, you can mark the exercises that you want to present.

Exercise 1  (6+9* points)

You can choose an arbitrary set of exercises this time. Each of the questions stated below gives 3 points. You should answer at least two and at most five of the following questions:

Chapter 5:
• Explain in your own words: The idea of the lower bound for the deterministic Job Shop Scheduling problem.
• Explain in your own words: The idea of the upper bound for the deterministic Job Shop Scheduling problem.
• Explain in your own words: The idea of the lower bound for the advice complexity of the Job Shop Scheduling problem.

Chapter 6:
• How can one advice bit help the algorithm and why are less than \( \log(n - 1) \) bits not more helpful for the knapsack problem?
• Explain in your own words: The idea of the upper bound for the advice complexity of the knapsack problem.
• Which competitive ratio can be achieved if the online algorithm has one random bit? Why?
• Explain in your own words: The idea for the online algorithm with augmented resources and advice.

Chapter 7:
• Why is the string guessing problem interesting? For what can it be used? Define the problem.
• Which competitive ratio can be achieved if the algorithm can use one random bit? Can this be improved with more random bits? Why?
• How does the algorithm for the string guessing problem work that uses \( n - \lfloor \log(n) \rfloor + 1 \) advice bits and makes only one error.
• Why does every online algorithm with advice, that guesses at least \( \gamma n \) bits correctly for every instance of bit guessing with unknown history, need at least \( n(1 + (1 - \gamma) \log(1 - \gamma) + \gamma \log \gamma) \) advice bits? (\( \frac{1}{2} \leq \gamma \leq 1 \))
• What is the difference for the lower bound proof for bit guessing with errors, if the history is known?
• What is an Advice-Preserving Reduction? Explain the reduction from the string guessing problem with known history to the 2-server problem on a path of length 2.
• Explain in your own words: The idea of the reduction from the string guessing problem with known history to the set cover problem.
• Explain in your own words: The idea of the reduction from the string guessing problem with known history to the disjoint path allocation problem.

Chapter 8:
• What are the lower bounds for online coloring trees and bipartite graphs?
• What is the lower and upper bound for the advice complexity for the minimal spanning tree problem? Explain the idea.
• Explain in your own words: The idea of the reduction from the string guessing problem with known history to the minimal spanning tree problem.