• Exercises appear at the i1 homepage (http://algo.rwth-aachen.de/en/Lehre/WS1617/TVPS.php) on Monday evening.

• 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 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.

• 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.

• 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.

Write for every solution the number of used Processors, the size of the memory, the used PRAM model and the running time of your algorithm.

Exercise 1 (4 points)

Show that the sorting algorithm from Cole works with $O(n)$ processors. Assume that the $n = 2^k$ elements which should be sorted are on layer $k$ in the Tree $T$. Think about some point in time where a layer $l \leq k$ finished sending information.

Exercise 2 (4 points)

Give a PRAM algorithm that calculates a non expandable independent set (not an optimal independent set) on a directed cycle $C_n$ of length $n$. You should achieve a run time of $O(\log^*(n))$ with the use of $n$ processors.

Exercise 3 (3 points)

This exercise appeared on sheet 3. If it was solved, do not solve it again.

Assume that on a Torus Grid Graph of dimension $(n \times n)$ (Crossproduct from two cycles of length $n$) every vertex knows only itself an its adjacent four neighbors.

Give an algorithm that colors the graph with 5 colors in a run time of $O(\log^*(n))$ with $n^2$ processors.

Hint: Every vertex has a binary number as ID and a vertex knows his own ID and the ID of its neighbors.

$$\log^*(n) := \begin{cases} 
0 & \text{if } n \leq 1 \\
1 + \log^*(\log(n)) & \text{if } n > 1 
\end{cases}$$