Exercise Sheet 5

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WS 16/17
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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)
Assume a tree $T$ with node degree at most $O(\log \log(n))$. Give an efficient parallel algorithm that colors the edges of the tree with a running time of $O((\log \log(n))^3)$ while using at most $2 \cdot \max(\text{degree})$ colors and $O(n)$ processors.

Note: For edge coloring two edges that are adjacent to the same vertex must not have the same color.

Exercise 2 (4 points)
Give a parallel algorithm with a running time of $O(\log^2(n))$ that calculates for a given undirected and connected graph $G = (V, E)$ a breadth-first tree. The root of the resulting tree is called $r$ and part of the input.

Exercise 3 (4 points)
Assume you have a directed, acyclic graph $G = (V, E)$ with $n$ vertices. Give a parallel algorithm that has a running time of $O(\log^2(n))$, uses $O(n^2)$ processors and calculates a labeling $l : V \rightarrow \{1...n\}$ for the vertices of $G$. For the labeling must hold that for every directed edge from $u$ to $v$ it holds $l(v) < l(u)$.