Albert-Ludwigs-Universität, Inst. für Informatik
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Algorithm Theory, Winter Term 2014/15
Problem Set 1

hand in (hard copied) by Thursday, 10:00, October 30, 2014, either before the lecture or in the box corresponding to your group in building no. 51.

Exercise 1: Complexity & Recurrence Relations (3+4 points)

a) Prove or disprove the following statements:

$$\log(n^2) \in \Omega\big((\log n)^2\big)$$
$$2^n \in \Theta(3^n)$$

b) Recurrence Relations:

The master theorem tells you that $T(n) \in \mathcal{O}(n^2)$ for the following recurrence relation:

$$T(n) = 4 \cdot T(\frac{n}{2}) + n,\ T(1) \leq 1.$$

Solve the recurrence relation by induction *without* using the master theorem.

Hint: Go through the repeated substitution and be precise when determining the value of the geometric sum.

Exercise 2: Triangle with shortest Perimeter (3 points)

Let $P = \{(x_i, y_i) \in \mathbb{R}^2 \mid i = 1, \ldots, n\}$ be a set of n points in $\mathbb{R}^2$. Given three distinct points $a, b, c \in P$ they span a triangle with *perimeter*

$$peri(a, b, c) = d(a, b) + d(b, c) + d(a, c),$$

where $d(\cdot, \cdot)$ determines the euclidean distance of two points.
Describe a $\mathcal{O}(n \cdot \log(n))$ algorithm which finds the smallest triangle perimeter in P. Argue shortly the correctness of your algorithm's running time.