CHRISTIAN-ALBRECHTS-UNIVERSITÄT ZU KIEL
Institut für Informatik, Arbeitsgruppe Theorie der Parallelität
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10. April 2019

Aufgaben zur Vorlesung »Approximative Algorithmen«

Blatt 1

Hausaufgabe 1.1 (MAX-SAT (6 Points))
Give a prove for the omitted claims from the randomized algorithm for the MAX-SAT problem:

1. Show that for all $k \geq 1$:
$$1-(1-\frac{1}{k})^k \geq 1-\frac{1}{e}.$$
Hint: Use that $(1+\frac{1}{n})^n$ is monotone in n and $e = \lim_{n\to\infty}(1+\frac{1}{n})^n$.
2. Show that for all $z \in [0,1]$ and $k \in \mathbb{N}^+$:
$$1-(1-\frac{z}{k})^k \geq (1-(1-\frac{1}{k})^k)z.$$
Hint: Prove that $f : [0,1] \to \mathbb{R}, z \mapsto 1-(1-\frac{z}{k})^k$ is concave.
3. Show that for every k positive numbers $a_1, \ldots, a_k$:
$$\frac{1}{k}\sum_{i=1}^{k} a_i \geq \left(\prod_{i=1}^{k} a_i\right)^{1/k}.$$

Hausaufgabe 1.2 (MAX-SAT (4 Points))
Determine for each $k \in \{1,2,3,4\}$ which method (1 or 2) will give the better results, if each clause contains exactly k literals.

Abgabe: 16. April 2019, 10:00 Uhr.