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6th Exercise sheet for Advanced Algorithmics, SS 15

Hand In: *Until Monday, 01.06.2015, 12:00am, in lecture, exercise sessions, hand-in box in stairwell 48-6 or via email.*

Problem 12

We have seen two different definitions of Las Vegas algorithms in class. Show that they are equivalent in a complexity-theoretic sense, that is

$$\begin{aligned} & P \text{ can be solved by an } \mathrm{LV}_{a)} \text{ algorithm in expected time } \Theta(f) \\ \Longleftrightarrow \quad & P \text{ can be solved by an } \mathrm{LV}_{b)} \text{ algorithm in expected time } \Theta(f) \end{aligned}$$

for some problem P and some function $f : \mathbb{N} \to \mathbb{N}$.

Problem 13

Show that any one-way OSE-MC algorithm for Equality_n has communication cost of at least n (bits).

Hint: For partial virtual credit, show the bound in a simpler setting; assume one of C_1 and C_2 has to be deterministic.

Problem 14

Give a TSE-MC-algorithm for Equality_n with communication complexity in $\mathcal{O}(\log n)$. Show that your algorithm has the necessary properties.

Note: You may assume that n is sufficiently large, that is your algorithm may violate the TSE-MC restrictions for finitely many n.

Problem 15

How do you construct a decider for L given an OSE-MC-algorithms for L and $\overline{L}$, respectively? Justify your answer.

Problem 16

a) Give algorithm A that generates random permutations of the numbers $1, \ldots, n$. Each permutation is to have the same probability.

Show that your algorithm has the desired property and determine $\text{Exp-Time}_A(n)$ as well as $\text{Random}_A(n)$.

b) Which of the classes of randomized algorithms known from lecture does A belong to?