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**Theory I, Sheet 6**

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**Submission: hand in by 29th June 2011 before 16:00**

- The solutions should be submitted in English.
- You must work on your own and write down your own solution. This does not exclude occasional discussions with your fellow students, but solutions copied from other students will not be accepted.

**Exercise 6.1 - Dynamic Tables**

[Points: 4]

Suppose that instead of contracting a table by halving its size when its load factor drops below  $1/4$ , we contract it by multiplying its size by  $2/3$  when its load factor drops below  $1/3$ . Using the potential function

$$\phi(T) = |2 \cdot \text{num} - \text{size}|$$

show that the amortized cost of a Table-Delete that uses this strategy is bounded by a constant.

**Exercise 6.2 - Dynamic Tables**

[Points: 2]

Consider the potential function from the lecture, chapter 9, page 14. Now, check:

$$\sum a_i \geq \sum t_i$$

**Exercise 6.3 - Randomized Quicksort**

[Points: 4]

Show that

$$\sum_{k=2}^{n-1} k \lg k \leq \frac{1}{2} n^2 \lg n - \frac{1}{8} n^2$$

**Hint:** Split the summation into two parts, one for  $k = 2, 3, \dots, \lceil n/2 \rceil - 1$  and one for  $k = \lceil n/2 \rceil, \dots, n - 1$ .