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Algorithms

WS 2013/14

Exercises 3

1. **MST - Approximation (Niveau I)**

   (a) Construct a complete graph with at least 6 nodes that satisfies the triangle inequality and apply the MST- approximation algorithm to approximate the optimal solution of the TSP.

   (b) Prove that the MST-approximation is a 2-approximation for the TSP.

2. **Landau Symbols (Niveau I)**

   Show the following:

   (a) $\forall k, l \in \mathbb{Z}.k > l : n^l = o(n^k)$

   (b) $\forall k, l \in \mathbb{N}.k > l : n^k + n^l = \Theta(n^k)$

   (c) $f = O(2^n) \Leftrightarrow f = 2^{O(n)}$?

3. **Amortized Analysis (Niveau I)**
   Consider a table with a certain number of allocated slots that allows for insertion and deletion operations. When called on a table that has no free slots left, *insert* allocates a new table having twice the number of slots and copies all previously inserted elements into the new table. Otherwise *insert* just inserts the new element into a free slot. The cost for inserting/copying an element into a free slot is $O(1)$ each.

   (a) Use the potential method and accounting method to show that the amortized cost of *insert* is $O(1)$.

4. **Analysis of SELECTION algorithm (Niveau II)**
   Read the additional PDF document (AdditionalMaterial) and solve Exercise 9.3-1