

Parallel Systems Theory Exam

January 29th 2009

1. What do we mean with **lost cycles** in a performance analysis of parallel computing? Why is the concept important? What is the relation with **latency hiding**?
2. **Point-to-point communication** consists of a simple send and receive. Data is copied from the memory of one computer into the memory of another. In what ways can a protocol optimize the operation in order to speedup the execution of the parallel program in which it is used? What should be taken into account when choosing among the possibilities? What are the advantages and disadvantages?
3. Consider the **Traveling Salesman Problem**. Given is a weighted graph G (left) connecting cities of a country, city A is the start of the salesman. The problem is to find the cycle of minimum cost visiting all of the cities of G exactly once (right). Design in pseudo-code an efficient parallel solution based on a tree search. The problem is NP-complete, which means that all possible cycles have to be checked. In the tree search, all possible paths are explored by starting at A and expanding the tree by adding the adjacent cities to the path. Also optimize the search by checking the paths against the until-then-smallest-found-cycle.

Choose between a multi-threaded and message-passing parallel solution. If you choose the last option, choose the cheapest, most efficient network.
4. **Design the necessary classes** to make the parallel solution of the previous question maximally reusable for similar problems without adding extra complexity. Define the interface classes and methods of the library. You don't have to implement them, only prove that they fit into your solution. What kind of problems can be solved? Also the shift-puzzle? Tip: underline the parts of your algorithm which are not generic.

