Programming Assignment 1

Shared memory parallelization using Pthreads

1 Quick-Sort

The Quick-sort algorithm is described numerously in the literature, e.g, a detailed description can be found in **http://en.wikipedia.org/wiki/Quicksort**, and briefly the algorithm follows as:

1. Select pivot element.
2. Divide the data into two sets according to the pivot (smaller and larger).
3. Sort each list with Quick-sort recursively.

The algorithm can be parallelized in many ways but a straightforward parallelization is to acquire a new thread for each list and proceed recursively sorting the two lists in parallel on the two threads. One problem is then to not acquire too many threads. After a number of recursion levels (use the level as argument, *not* a thread counter) one can proceed without requiring new threads by calling a serial Quick-sort function. What is the optimal level to stop acquiring new threads and what factors affects the performance? Sort random number sequences with up to 100.000.000 elements and measure the speedup using your parallel implementation, report results from different parallel computers, e.g., your laptop, login servers at IT and Gullviva. You can also run on UPPMAX computers Kalkyl, Tintin and Halvan.

2 Writing a report on the results

The report can be written in Swedish or English but you should use a word processor or a type setting system (e.g. Latex, Word, StarOffice). The report should cover the following issues:

Report requirements:
1. *Problem description*, presenting the task.
2. *Solution method*, i.e. a description of the parallel implementation.
3. *Results*, presenting plots of speedup. The plots can be done using Matlab, Maple or any other graphical tool.
4. *Discussion*, with observations and comments on the results (can also be included in 3 above).
5. *Conclusions*, with explanations of the results and with ideas for possible optimizations or improvements.
6. *Appendix*, with a listing of the program code and tables of the numerical results.

The last day to hand in the report is **March 12, 2012** but try to do it as soon as possible.