Automatic Generation and Analysis of Algorithms Assignment #3

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Linear algebra operations

Operations:

$$y := \|A\|_1, \quad y := \|A\|_{\inf}, \quad y := \|A\|_F, \quad A := A^T, \quad y := Ax, \quad y^T := x^T A$$

Setup:

- Use the same operation as for the first assignment.

- Consider both $A \in \mathbb{R}^{4 \times 4}$ and $A \in \mathbb{R}^{8 \times 8}$.

- First assume that the matrix is stored by columns,
  then repeat the exercise assuming storage by rows.

What to do

1) Declare & initialize A (and x and y) with single precision floating point numbers.

2a) Implement your two algorithms from HW #1, using Cilk.

2b) If you have not already done so, add pragmas to your plain C implementations (HW #1) such that the compiler is able to automatically vectorize them.

3) Verify that the algorithms are correct! Output "success" vs. "error".

4) Generate the assembly code corresponding to each of implementations, and count separately the number of instructions relative to the **reading/writing** of the data (`mov`), to the **floating point operations** (`mul`, `add`, `div`, `sub`, `rcp`, `sqrt`), and the rest (`shuf`, `insert`, `extract`, `perm`, ...).

5) Use the cycle-accurate timer and time the algorithms.

6) The objective is to see what compilers can do with suitable choice of flags, what Cilk attains, and compare with your results from HW #1 and HW #2. Report your results in a clear and visibly pleasant manner.

Submission

- Individual assignment.

- Submission by email to pauldj@aices.rwth-aachen.de

- Email's subject: ``AGAA-14 HW3 your_last_name''

- Submit your *.c files (and possibly the *.s too),
  together with a report (table, figure, discussion, . . .).
  Submit your Makefile too.

- Indicate which flags you used.

- Make sure the files compile correctly.

- Archive them: your_name.zip or your_name.tgz

- Include your name inside each file.

- **Deadline: Tuesday, June 24th, 5pm.**