

Automatic Generation and Analysis of Algorithms

Assignment #1

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A simple linear algebra operation

Operations:

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

Setup:

- Consider $A \in \mathbb{R}^{n \times n}$; x and y are vectors of size n .
- First assume that $n = 4$,
then repeat the exercise assuming that $n = 8$.
- 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.
- 2) Write two algorithms –in C– to compute the operation for a given matrix size (4,8), and storage scheme (columns, rows).
- 3) Verify that the algorithms are correct.
- 4) Generate the assembly code corresponding to the algorithms, and count separately the number of instructions relative to the **reading/writing** of the data, and to the **floating point operations**.
 - Optionally, experiment with different optimization levels and compilation flags.
- 5) Use the cycle-accurate timer and time the algorithms.
(both cold and warm data is fine)
- 6) Report all 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 HW1 your_last_name”
- Submit your *.c files (and possibly the *.s too) together with a report (table, figure, discussion, ...).
- Make sure the files compile correctly.
- Archive them: `your_name.zip` or `your_name.tgz`
- Include your name inside each file.
- **Deadline: Tuesday, May 6th, 5pm.**