Exercises - Lecture 4

February 17, 2011

1. Motivation

Explain in words why numerical simulations often requires significant computing power. Print out your explanation and bring it to class.

2. Floating point vs. Integer

(a) Create a C program that performs a large number of integer operations and measures the time used.

(b) Modify the program to do exactly the same calculations but with doubles instead of integers. Compare the time.

3. Division of labor

(a) Create a programthat allocates a 1D array of runtime-prescribed length n, assigns the values of the array with random doubles, and finds the maximum and minimum values. Measure the time it takes to find max and min.

(b) Split the array into 10 smaller arrays, find the maximum and minimum in each array, and then the maximum and minimum of the results.

(c) Measure the time spent on each of the smaller arrays, and on the process as a whole. Compare with the time for the big array. What do you think would be achieved by parallelizing this program?

4. Memory hole

We have the following declaration of a *C struct*.

```
struct foo{
    int a;
    double b;
    int c;
};
```

How much memory do you think it should use? Check its real size with "*sizeof*". Can you reduce the size?

5. Titan test

A, B and C are matrices respectively containing 1024×1024 *double* elements. Implement a *C* code for matrix multiplication, $C = AB$. Run it on Titan using a serial job script and save the matrix C in a binary file. Do you have any way to make the code run faster?