Computer Architecture Homework

June 12, 2016

Abstract

Homework for 2016/6/13

Today's homework consists of two parts: a little systems work, and a little math.

The systems work to be done is just in preparation for the homework to be done later in the semester.

1. Install the `spim` simulator for the MIPS microprocessor. There are several versions available; you may install any version that works on your PC. *We will be using this in class two weeks from now! You must have it installed and running by then!*

One possibility I *strongly encourage* you to try if you have an Android device is this MIPS simulator developed by students from De La Salle University in the Philippines: `https://play.google.com/store/apps/details?id=thesis.dlsu.com.mmipss` with a tutorial available at `http://bit.ly/MMIPSStutorial` or `https://prezi.com/sy4zwhgedpp7/mmipss/?utm_campaign=share&utm_medium=copy`.

Okay, here's the math part:

This is the first of a string of three homeworks. There will be follow-on homework from this next week, so you must have this done by then!

Take the two matrices:

$$A = \begin{pmatrix} 1 & 0 & 3.14 & 2.72 \\ 2.72 & 1 & 0 & 3.14 \\ 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \end{pmatrix} \tag{1}$$

$$B = \begin{pmatrix} 1 & 1 & 0 & 3.14 \\ 0 & 1 & 3.14 & 2.72 \\ 0 & 1 & 1 & 0 \\ 4 & 3 & 2 & 1 \end{pmatrix} \tag{2}$$

Do the following:

1. Find the matrix product AB. Do this by hand, and show your work.
2. Count
   (a) the number of real (floating point) multiplications necessary, and
   (b) the number of real (floating point) additions necessary.
3. Express
   (a) the number of real (floating point) multiplications necessary, and
   (b) the number of real (floating point) additions necessary

   as a function of N for multiplying two $N \times N$ matrices.
4. Write *pseudocode* for a program to multiply two $N \times N$ matrices.