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EECS 645 – Homework #02

Due (in class): February 20, 2018

1 Description

For Homework #03 you will execute a program on a computer of your choice and report your results. The program is designed to execute on UNIX-like systems, i.e. it uses calls to the standard lib.c. I have executed the program on Mac OS X and Linux. I have no experience executing the program on Windows.

The program source code is at:
http://www.ittc.ku.edu/~gminden/Computer_Architecture/Software/CacheBenchmark.c

[[Be careful with URLs that span more than one line. Make sure you use the complete URL.]]

2 Questions

When answering questions make sure you include units, when appropriate.

On macOS you can find (some) information about your processor under the "Apple" menu, selecting "About This Mac," and the select "System Report…"

On Linux you can use the command "cat /proc/cpuinfo" and/or "lscpu". To find main memory size use "cat /proc/meminfo".

On Windows I think you can use the command "msinfo32". (This does not seem to work on my Windows 7 VM.)

1. Which CPU did you execute CacheBenchmark on? E.g. "Intel(R) Xeon(R) CPU 5130 @ 2.00GHz."

   CPU: Intel(R) Core(TM) M-5Y31 @1.1GHz

2. What is the clock rate of the CPU?

   1.1GHz

3. What is the size and associativity of the L1 cache?

   32KB 8-way associativities

4. What is the size and associativity of the L2 cache?

   256KB 8-way associativities

5. What is the size and associativity of the L3 cache?

   4Mb 16-way associativities

6. How many seconds did it take to execute the first triple loop ("Last index fastest")?

   23s

7. How many seconds did it take to execute the second triple loop ("First index fastest")?

   186s

8. How many seconds did it take to execute the third triple loop (“Random indicies, no data access”)?

   391s

9. How many seconds did it take to execute the fourth triple loop (“Random indicies, with data access”)?

   1852s

10. Explain why there are both the third triple loop and a fourth triple loop.

    The third triple loop just random index, they do not store data, but the fourth triple loop is random index and access data.

    If cache access data in random, it cost too much time.

11. Explain the differences, if any, between the execution time of the first triple loop, the second triple loop, and the fourth triple loop.

    The first and the second triple loop is about loop interchange. The first loop would skip through memory in I, J, and K in order, but the second loop is reverse order. The fourth loop is skip through memory in random.

12. Why is the array allocated outside the “main” subroutine?

    If array is not allocated outside, the error is segmentation fault, which mean stack overflow because the size of array is so large.

