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10/10/2019
CST337
Lab 2 answers

5. I made the following changes:
- Commented out all fprintf calls in fourierf.c
- Changed <fourier.h> and <ddcmath.h> to use quotes in fourierf.c
- Changed <fourier.h> to use quotes in fftmisc.c

| Step | Configuration | Time in Cycles (d) | Time in Seconds |
|---|---|---|---|
| 9,10 | No Optimization, Cache Off, Prefetch Off, WS = 7 | 11,790,941 | 0.1404 |
| 11 | Optimization 1, Cache Off, Prefetch Off, WS = 7 | 10,085,444 | 0.12006 |
| 12 | Optimization 1, L1 Cache Off, Prefetch Off, WS = 1 | 8,612,142 | 0.1025 |
| 13 | Optimization 1, L1 Cache Off, Prefetch On, WS = 7 | 8,367,741 | 0.0996 |
| 14 | Optimization 1, L1 Cache Off, Prefetch On, WS = 1 | 8,041,134 | 0.0957 |
| 15 | Optimization 1, L1 Cache On, Prefetch Off, WS = 7 | 802,803 | 0.009557 |
| 16 | Optimization 1, L1 Cache On, Prefetch On, WS = 1 | 801,674 | 0.00954 |
| 17 | Optimization 1, L1 Cache On, Prefetch On, WS = 1 Second Pass | 799,629 | 0.00952 |

a) Which feature, by itself, improved performance the most?

The cache alone made the greatest improvement.

b) How do you account for the fact that turning the prefetch unit on (step 13) gives a greater performance boost than setting the wait states to 1 (step 12)? Would this be true for all programs? State why or why not.

If the program requests access for a word that was previously prefetched (or the adjacent words to the prefetch,) it can be accessed without a wait state. This would be beneficial for repetitive programs or programs that repeatedly access data or instructions that are stored close together.

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c) Why was there less of a performance gain from turning the prefetch unit on and setting wait states to 1 between steps 15 and 16 than there was between steps 11 and 14?

When the cache is turned on, instructions and data can be held directly on the chip which lowers the effectiveness of prefetching.

d) Why was the execution time reduced on the second pass in step 17?

The fft_float call is held in cache after the first loop. This reduces the time it takes to fetch the instructions/data.