CS 475

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Project 4

1. What machine you ran this on

On Flip Server.

1. Show the table of performances for each array size and the corresponding speedups.

|  |  |  |  |
| --- | --- | --- | --- |
| Array Size (2^x) | Non-SIMD | SIMD | Speedup |
| 10 | 115.592055 | 787.615779 | 6.813754 |
| 11 | 121.305343 | 866.439423 | 7.142632 |
| 12 | 121.291961 | 856.651054 | 7.062719 |
| 13 | 120.921792 | 835.971585 | 6.913324 |
| 14 | 63.252121 | 444.404235 | 7.025918 |
| 15 | 121.098257 | 962.426065 | 7.947481 |
| 16 | 120.943822 | 904.901293 | 7.481997 |
| 17 | 118.767817 | 895.151368 | 7.536986 |
| 18 | 119.92376 | 875.527157 | 7.300698 |
| 19 | 118.313675 | 850.138712 | 7.185465 |
| 20 | 117.118641 | 761.844767 | 6.504898 |
| 21 | 115.317373 | 653.231437 | 5.66464 |
| 22 | 110.833109 | 398.141901 | 3.592265 |
| 23 | 114.496856 | 599.690039 | 5.237611 |

1. Show the graph of SIMD/non-SIMD speedup versus array size (one curve only).

Not using OMP Parallel

1. What patterns are you seeing in the speedups?

SIMD adds a significant performance boost across all observed array sizes. There is a noticeable speedup decrease when the array size is 1MB or greater. The rebound in speedup at an array size of 4MB is interesting, I’m not sure why 3MB would run slower.

1. Are they consistent across a variety of array sizes?

The speedups are within 1x speedup of each other up until the array size gets to 1MB. Then it seems to lose consistency.

1. Why or why not, do you think?

I would think this is because the array is too large to cache and the program will have to go out and fetch normally out in the memory. A fix could be extending the SSE\_WIDTH so that there are more vectors so that each one is doing calculations on less elements.

Extra-Credit:

This graph is showing the speedups of multi-core SIMD vs single-core SIMD. The single-core SIMD is not using omp parallel for loop; I did this because if you were to implement this in a real application you wouldn’t use omp parallel and only use one core. These curves are showing speedup for different core counts as array size increases. Adding more cores increases the speedup as it would be expected. The spike at 214 array size I would assume it is something to do with setup time. The large drop in speedup at array size 223 would probably be due to cache size since all the speedups are converging, it would appear to be some hardware limitations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Array Size (2^x) | Core Count | Speedup | Single-core SIMD | Multi-core SIMD |
| 10 | 2 | 0.468770987 | 787.6158 | 369.2114 |
| 11 | 2 | 0.611271677 | 866.4394 | 529.6299 |
| 12 | 2 | 0.784775298 | 856.6511 | 672.2786 |
| 13 | 2 | 0.916231278 | 835.9716 | 765.9433 |
| 14 | 2 | 1.84584538 | 444.4042 | 820.3015 |
| 15 | 2 | 1.016120963 | 962.4261 | 977.9413 |
| 16 | 2 | 1.051916782 | 904.9013 | 951.8809 |
| 17 | 2 | 1.05392216 | 895.1514 | 943.4199 |
| 18 | 2 | 1.072898867 | 875.5272 | 939.3521 |
| 19 | 2 | 1.096007812 | 850.1387 | 931.7587 |
| 20 | 2 | 1.185358552 | 761.8448 | 903.0592 |
| 21 | 2 | 1.322984094 | 653.2314 | 864.2148 |
| 22 | 2 | 1.910524012 | 398.1419 | 760.6597 |
| 23 | 2 | 1.220125175 | 599.69 | 731.6969 |
| 10 | 4 | 0.483379502 | 787.6158 | 380.7173 |
| 11 | 4 | 0.76033553 | 866.4394 | 658.7847 |
| 12 | 4 | 1.118518519 | 856.6511 | 958.1801 |
| 13 | 4 | 1.4988604 | 835.9716 | 1253.005 |
| 14 | 4 | 3.338336987 | 444.4042 | 1483.571 |
| 15 | 4 | 1.896555303 | 962.4261 | 1825.294 |
| 16 | 4 | 2.114301251 | 904.9013 | 1913.234 |
| 17 | 4 | 2.179038695 | 895.1514 | 1950.569 |
| 18 | 4 | 2.144681191 | 875.5272 | 1877.727 |
| 19 | 4 | 2.206948269 | 850.1387 | 1876.212 |
| 20 | 4 | 2.282148448 | 761.8448 | 1738.643 |
| 21 | 4 | 2.612731494 | 653.2314 | 1706.718 |
| 22 | 4 | 3.500647419 | 398.1419 | 1393.754 |
| 23 | 4 | 2.07727677 | 599.69 | 1245.722 |
| 10 | 6 | 0.419471154 | 787.6158 | 330.3821 |
| 11 | 6 | 0.702657807 | 866.4394 | 608.8104 |
| 12 | 6 | 1.091875798 | 856.6511 | 935.3566 |
| 13 | 6 | 1.523602665 | 835.9716 | 1273.689 |
| 14 | 6 | 4.003438511 | 444.4042 | 1779.145 |
| 15 | 6 | 2.297511313 | 962.4261 | 2211.185 |
| 16 | 6 | 2.736627253 | 904.9013 | 2476.378 |
| 17 | 6 | 2.958637561 | 895.1514 | 2648.428 |
| 18 | 6 | 2.805634098 | 875.5272 | 2456.409 |
| 19 | 6 | 2.992471215 | 850.1387 | 2544.016 |
| 20 | 6 | 3.147584138 | 761.8448 | 2397.971 |
| 21 | 6 | 3.558618825 | 653.2314 | 2324.602 |
| 22 | 6 | 4.299371789 | 398.1419 | 1711.76 |
| 23 | 6 | 2.313688537 | 599.69 | 1387.496 |
| 10 | 8 | 0.424832624 | 787.6158 | 334.6049 |
| 11 | 8 | 0.663355985 | 866.4394 | 574.7578 |
| 12 | 8 | 1.211420481 | 856.6511 | 1037.765 |
| 13 | 8 | 2.008781979 | 835.9716 | 1679.285 |
| 14 | 8 | 5.254313776 | 444.4042 | 2335.039 |
| 15 | 8 | 3.139642735 | 962.4261 | 3021.674 |
| 16 | 8 | 3.762167394 | 904.9013 | 3404.39 |
| 17 | 8 | 4.05336702 | 895.1514 | 3628.377 |
| 18 | 8 | 4.272886762 | 875.5272 | 3741.028 |
| 19 | 8 | 4.119199285 | 850.1387 | 3501.891 |
| 20 | 8 | 4.499689435 | 761.8448 | 3428.065 |
| 21 | 8 | 4.78130791 | 653.2314 | 3123.301 |
| 22 | 8 | 4.735954845 | 398.1419 | 1885.582 |
| 23 | 8 | 2.416501916 | 599.69 | 1449.152 |