CS 575

Project #4

Vectorized Array Multiplication/Reduction using SSE

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Code was run on the flip server. Got Speed-Up as:

1. Performance for each array size and corresponding speedups:

|  |  |  |  |
| --- | --- | --- | --- |
| Size | Single Core (MegaMultsPerSec) | SIMD (MegaMultsPerSec) | Speedup |
| 1000 | 131.682833 | 342.17394 | 2.59847 |
| 5000 | 241.181901 | 641.269603 | 2.658863 |
| 10000 | 241.703094 | 643.575776 | 2.662671 |
| 50000 | 251.801452 | 669.098073 | 2.657245 |
| 100000 | 251.919607 | 670.510325 | 2.661604 |
| 500000 | 236.440348 | 347.176468 | 1.468347 |
| 1000000 | 234.159943 | 621.563976 | 2.654442 |
| 2000000 | 232.673685 | 590.801975 | 2.539187 |
| 3000000 | 225.443684 | 584.293115 | 2.591748 |
| 4000000 | 239.853387 | 607.59806 | 2.533206 |
| 5000000 | 238.588744 | 602.878242 | 2.526851 |
| 6000000 | 238.340764 | 534.627881 | 2.243124 |
| 7000000 | 230.03119 | 589.411841 | 2.562313 |
| 8000000 | 239.015102 | 599.861381 | 2.509722 |

1. The graph of SIMD/non-SIMD speedup versus array size:
2. The speedups of test combining multithreading and SIMD:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size | SIMD | 2 Cores + SIMD | 4 Cores + SIMD | 8 Cores + SIMD |
| 1000 | 2.59847 | 0.903291 | 1.748355 | 1.402524 |
| 5000 | 2.65886 | 4.235233 | 3.933112 | 6.316821 |
| 10000 | 2.66267 | 2.677268 | 7.755898 | 9.233811 |
| 50000 | 2.65725 | 2.86458 | 9.588653 | 15.046833 |
| 100000 | 2.6616 | 5.218427 | 10.295411 | 10.221418 |
| 500000 | 1.46835 | 5.33923 | 10.67163 | 21.026654 |
| 1000000 | 2.65444 | 2.883432 | 6.040261 | 20.414057 |
| 2000000 | 2.53919 | 5.038235 | 6.902552 | 20.402499 |
| 3000000 | 2.59175 | 4.796988 | 5.772257 | 11.329599 |
| 4000000 | 2.53321 | 4.86026 | 5.958438 | 10.498353 |
| 5000000 | 2.52685 | 4.908027 | 5.653945 | 11.175813 |
| 6000000 | 2.24312 | 4.804363 | 5.43546 | 10.040108 |
| 7000000 | 2.56231 | 4.76838 | 5.367221 | 9.399038 |
| 8000000 | 2.50972 | 4.929624 | 5.392463 | 9.456673 |

Commentary:

The code was run on the flip server. From the graph “Speedup for SIMD”, we can observe that the speedups tend to be stable regardless of the array size. I think it is because the size of dataset does not really affect the setup of SIMD instructions.

For the extra credit, we can observe that the speedups of 2/4 cores + SIMD are constant at about 5x, while the speedup of 8 cores + SIMD are about 10x. I think it indicates that there can be improvement to get the full power of multithreading + SIMD, such as using Prefetching and OpenMP’s SIMD directives.