CS 575

Project #4

Vectorized Array Multiplication/Reduction using SSE

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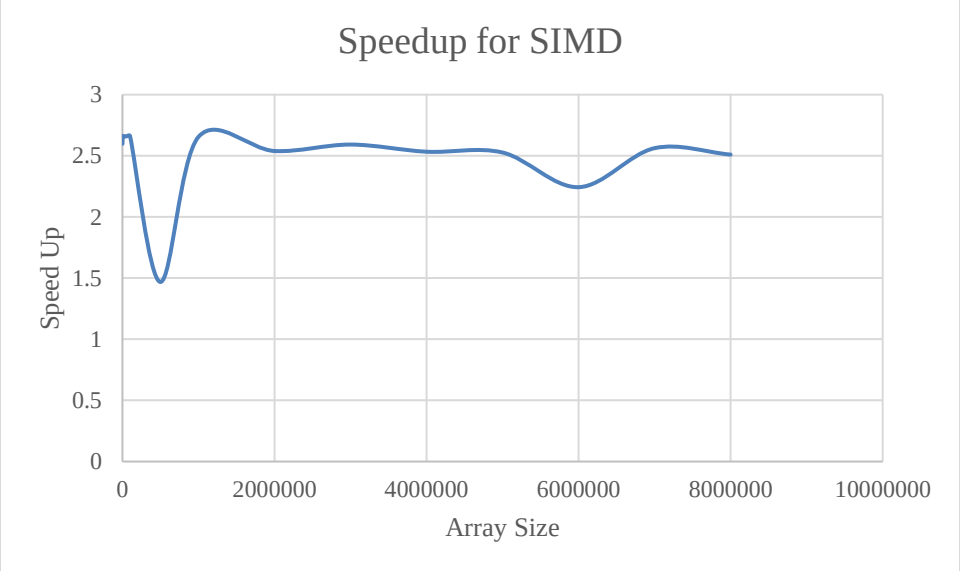
Code was run on the flip server. Got Speed-Up as:

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

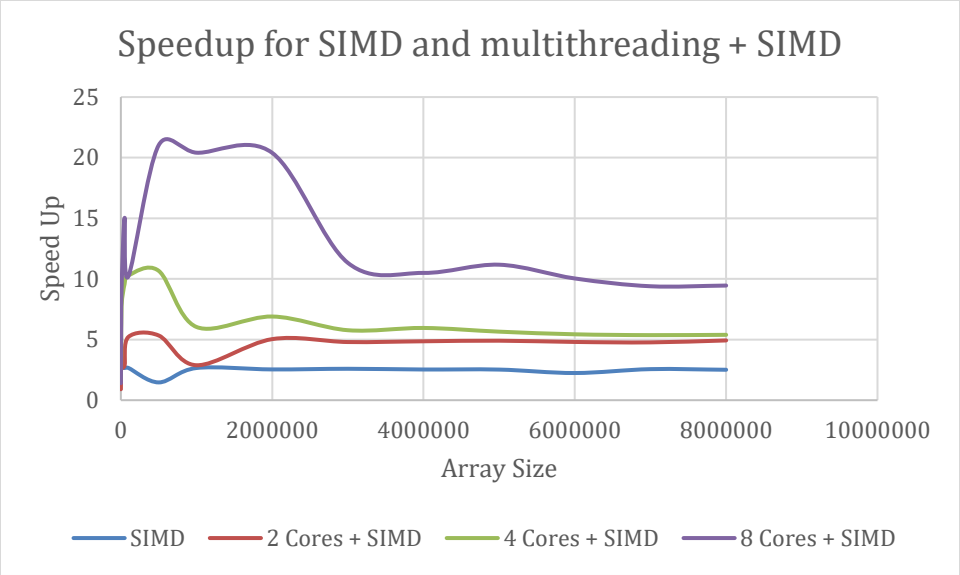
2. The graph of SIMD/non-SIMD speedup versus array size:



3. 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.