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Class: CS_575

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1. What machine you run this on?

Ans: I have run this on the Flip machine.

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

Ans:

ArraySize	MMN	MMS	Speedup(MMN/MMS)	MMNSum	MMSSum	Speed(MMNSum/MMSSum)
1024	220.72	1818.88	8.24	223.5	1793.66	8.03
2048	222.52	1877.1	8.44	224.3	1865.16	8.32
4096	222.15	1764.87	7.94	225.03	1886.76	8.38
8192	221.5	1794.57	8.1	225.85	1850.06	8.19
16384	221.55	1759.66	7.94	225.94	1850.93	8.19
32768	221.32	1398.26	6.32	225.88	1815.08	8.04
65536	221.35	1330.57	6.01	225.79	1807.25	8
131072	221.14	1362.78	6.16	232.11	1894.08	8.16
262144	220.17	1310.42	5.95	225.01	1809.95	8.04
524288	219.11	1337.99	6.11	224.31	1780.53	7.94
1048576	215.67	892.82	4.14	225.5	1660.38	7.36
2097152	215.89	493.67	2.29	227.37	1264.11	5.56

3. Show the graph of SIMD/non-SIMD speedup versus array size (either one graph with two curves, or two graphs each with one curve)

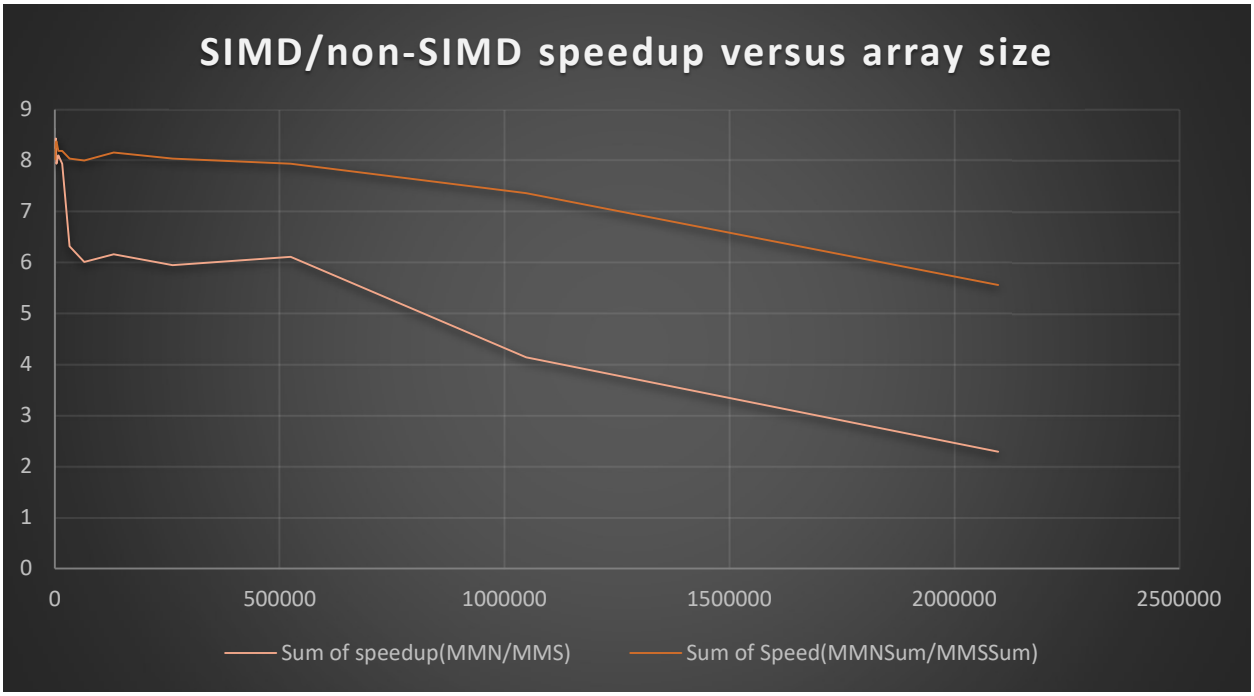
Ans:

MMN: Performance of Non-SIMD Multiplication

MMS: Performance of SIMD Multiplication

MMNSum: Performance of Non-SIMD Multiplication Sum

MMSSum: Performance of SIMD Multiplication Sum



4. What patterns are you seeing in the speedups?

Ans:

My graph shows that the SIMD/Non-SIMD speed up in this:

The orange line shows the speedup of SIMD/Non-SIMD for multiplication let's take it as O.

The yellow line shows the speedup of SIMD/Non-SIMD for multiplication let's take it as Y.

Initially, when the graph started both graphs had a slight up and down the after that until the array size is 500,000 the graph it was flowing in a straight line.

The straight flow of the graph got a break-even point when the graph reached 520,000 from that point the graph shows a continuous drop.

I feel this drop in the graph is expected as the size of the array is becoming too long to handle.

I saw a slight bit of parallel flow between the graphs O and Y graphs are maintained 2 units until the graph reached 500,000. After that, the speed difference grows rapidly.

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

Ans:

Initially, there was a both have up and down, and graph Y has performed way better than the graph O but after a certain point graph shows a sharp dip.

From that dip till the 500,000 the graphs Y and O are consistent, and they maintain 2 Unit differences because of memory wait prefetch. After the array size reached 520,000 the graph showed the dip, and it became inconsistent with respect to the array size.

6. Why or why not, do you think?

Ans:

Initially, the graph had ups and downs, at that time graph Y performed better than graph O. But after the initial array size exceed the initial point, the graph started showing consistency until the 500,000 this consistency is due to the memory wait prefetch.

After the 500,000 mark the graph started to fall steeply, I feel, this fall in speed was due to an increase in array size and the overload usage of the FLIP server.

EXTRA CREDIT

7. Combine multithreading and SIMD in one test. In this case, you will vary both the array size and the number of threads (NUMT). Show your table of performances. Produce a graph similar to the one on Slide #20 of the SIMD Vector notes, using your numbers. Add a brief discussion of what your curves are showing and why you think it is working this way.

Ans:

ArraySize	MMN	MMS	SpeedUp(MMN/MMS)	MMNSum	MMSSum	SpeedUp(MMNSum/MMSSum)	Threads
1024	221.41	5975.61	26.99	223.55	5832.95	26.09	4
2048	166.14	6603.67	39.75	172.38	6653.63	38.6	4
4096	221.04	7251.52	32.81	224.62	7162.94	31.89	4
8192	166.5	6420.51	38.56	172.58	7460.64	43.23	4
16384	221.52	6442.84	29.08	225.95	7538.97	33.37	4
32768	166.01	5095.12	30.69	225.87	7387.79	32.71	4
65536	221.47	6736.75	30.42	225.85	7429.52	32.9	4
131072	221.36	4321.81	19.52	225.82	7280.78	32.24	4
262144	217.96	5280.71	24.23	223.11	7218.42	32.35	4
524288	218.94	5278.68	24.11	224.27	7259.47	32.37	4
1048576	215.61	5068.7	23.51	222.75	7237.51	32.49	4
209715	214.	4639.7	21.62	220.64	7119.5	32.27	4

2	58	4			4		
1024	220.23	8523.35	38.7	221.74	9687.33	43.69	8
2048	222.27	10496.53	47.22	222.95	11635.04	52.19	8
4096	152.11	12336.74	81.1	159.4	12216.8	76.64	8
8192	221.52	12494.45	56.4	225.82	14325.88	63.44	8
16384	221.69	10639.36	47.99	225.94	14921.28	66.04	8
32768	221.1	12434.84	56.24	225.82	15032.84	66.57	8
65536	221.77	12468.99	56.22	225.75	14766.29	65.41	8
131072	220.54	12228.47	55.45	225.75	14767.06	65.41	8
262144	219.53	10762.63	49.03	224.95	14401.01	64.02	8
524288	218.79	9778.36	44.69	224.43	14486.24	64.55	8
1048576	215.88	9675.88	44.82	223.28	14423.98	64.6	8
2097152	213.04	9633.72	45.22	220.64	14455.93	65.52	8
1024	220.54	7825.71	35.48	220.32	9950.33	45.16	12
2048	221.72	12049.44	54.35	220.23	14858.27	67.47	12
4096	221.59	16596.4	74.9	220.08	17951.21	81.57	12
8192	166.48	19080.46	114.61	225.87	20128.36	89.11	12
16384	221.62	20551.62	92.73	225.92	21705.35	96.08	12
32768	164.65	21976.5	133.47	170.99	22460.5	131.35	12
65536	164.98	15287.58	92.66	172.22	21897.85	127.15	12
131072	221.3	18840.36	85.13	225.83	20563.63	91.06	12
262144	219.12	13367.61	61.01	224.95	21857.89	97.17	12
524288	218.89	15367.92	70.21	224.43	21612.85	96.3	12
1048576	215.82	15015.5	69.57	223.35	21568.14	96.57	12

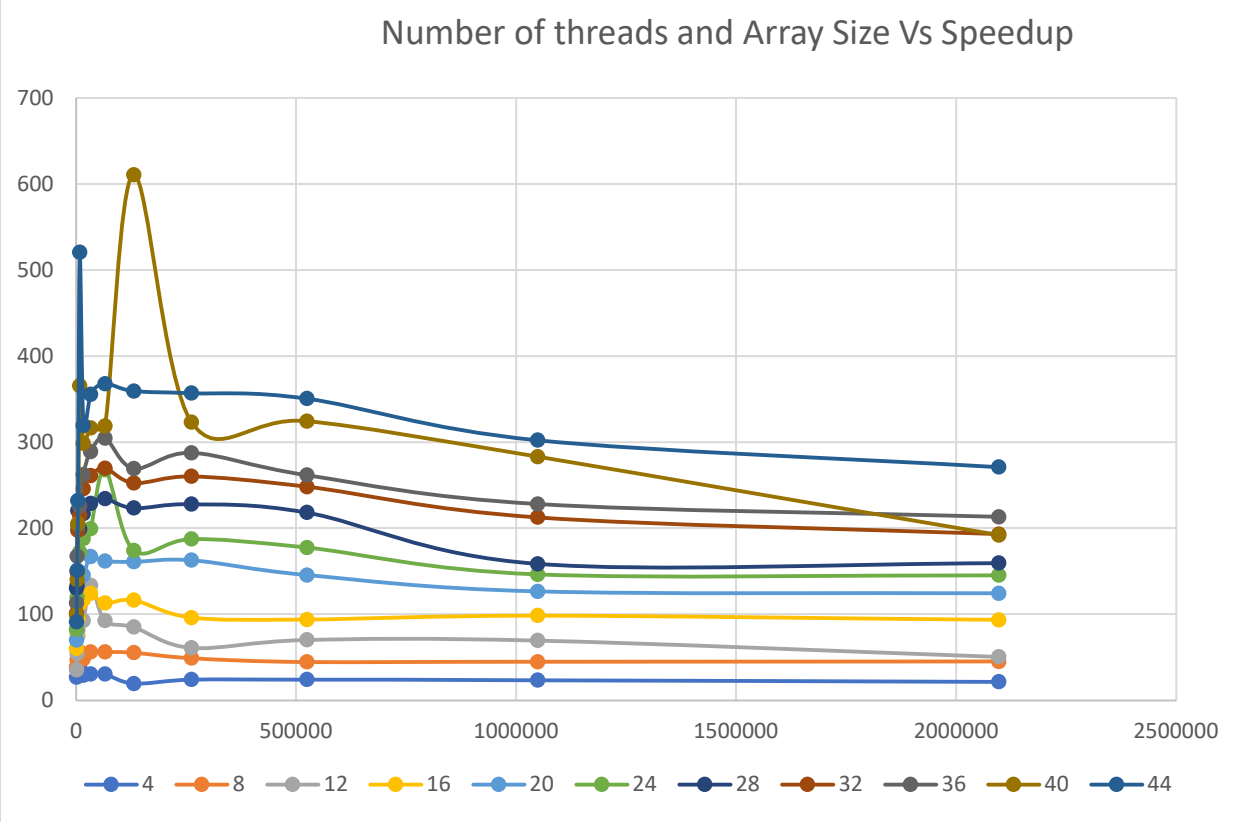
2097152	214.59	10862.57	50.62	219.81	21096.22	95.97	12
1024	221.74	13408.68	60.47	223.43	14372.7	64.33	16
2048	222.05	17113.02	77.07	219.94	19374.65	88.09	16
4096	221.84	21093.75	95.09	219.66	23270.09	105.94	16
8192	221.67	24847.72	112.09	225.82	26695.27	118.22	16
16384	221.41	25851.85	116.76	225.94	28651.77	126.81	16
32768	220.86	27466.33	124.36	225.84	29855.22	132.19	16
65536	221.23	25002.22	113.02	225.77	30040.02	133.06	16
131072	220.87	25696.09	116.34	225.81	29572.91	130.96	16
262144	217.52	20924.4	96.2	224.98	29593.12	131.54	16
524288	219.18	20565.13	93.83	224.46	28965.04	129.04	16
1048576	216.38	21306.91	98.47	221.96	25940	116.87	16
2097152	214.95	20104.82	93.53	221.11	28643.75	129.55	16
1024	220.94	15486.08	70.09	221.74	12785.02	57.66	20
2048	222.35	18098.96	81.4	219.45	20267.5	92.35	20
4096	221.52	31302.82	141.31	225.17	28466.32	126.42	20
8192	221.57	33005.98	148.96	225.83	31026.78	137.39	20
16384	221.35	32190.64	145.43	225.97	32578.12	144.17	20
32768	221.21	36919.59	166.9	225.86	36536.21	161.76	20
65536	221.1	35756.48	161.72	225.81	35874.97	158.87	20
131072	220.99	35571.21	160.96	225.8	34052.14	150.8	20
262144	219.55	35772.38	162.94	224.97	34267.71	152.32	20
524288	219.09	31902.41	145.61	224.24	36388.61	162.27	20
104857	208.	26389	126.66	220.63	35109.	159.13	20

6	35				22		
2097152	214.88	26733.78	124.41	220.86	36322.87	164.46	20
1024	221.7	18325.19	82.66	223.93	14467.26	64.61	24
2048	222.39	26654.83	119.85	220.5	21349.74	96.83	24
4096	221.93	33068.02	149	219.81	29716.53	135.19	24
8192	221.73	38160.92	172.1	225.84	35829.3	158.65	24
16384	221.3	41589.09	187.93	225.91	40256.72	178.19	24
32768	221.45	44173.73	199.47	225.82	40793.47	180.64	24
65536	164.44	44035.51	267.8	225.8	44921	198.95	24
131072	220.84	38479.15	174.24	225.82	44166.79	195.59	24
262144	219.63	41160.34	187.41	224.97	44281.44	196.83	24
524288	218.37	38761.31	177.5	224.43	43756.55	194.97	24
1048576	216.46	31685.59	146.38	223.46	43471.88	194.54	24
2097152	214.99	31251.34	145.36	220.84	43347.61	196.28	24
1024	168.95	21990.23	130.16	174.83	16534.01	94.57	28
2048	222.29	29716.53	133.68	224.29	24433.59	108.94	28
4096	166.01	36650.39	220.77	172.08	32821.24	190.74	28
8192	221.62	44090.69	198.94	225.82	41589.09	184.17	28
16384	221.5	48066.08	217	225.93	46417.38	205.45	28
32768	221.37	50661.44	228.86	225.86	49942.33	221.12	28
65536	221.09	51779.8	234.2	225.79	52474.83	232.4	28
131072	221.02	49381.57	223.42	225.82	51827.47	229.51	28
262144	219.58	50053.34	227.95	225.07	51736.97	229.87	28
524288	219.23	47871.93	218.36	224.35	51587.62	229.94	28

1048576	216.2	34281.8	158.57	223.4	50621.58	226.6	28
2097152	214.83	34275.01	159.55	220.8	50622.72	229.27	28
1024	221.61	22439.01	101.26	223.55	16534.01	73.96	32
2048	221.82	33068.02	149.08	224.26	28934.52	129.02	32
4096	221.71	43761.66	197.38	225.32	38749.31	171.98	32
8192	221.57	47675.3	215.17	225.82	46663.62	206.64	32
16384	221.61	54464.97	245.77	225.9	53390.55	236.35	32
32768	220.94	57726.62	261.28	225.89	57303.54	253.67	32
65536	221.52	59735.78	269.66	225.79	59634.53	264.12	32
131072	221.26	55903.67	252.66	225.8	60234.32	266.75	32
262144	219.65	57163.89	260.25	225.01	59170.69	262.97	32
524288	219.13	54409.7	248.3	224.47	59295.34	264.16	32
1048576	216.37	46012.38	212.65	223.21	57353.16	256.95	32
2097152	214.68	41483.36	193.23	220.82	59845.32	271.02	32
1024	220.87	24988.9	113.14	223.52	17452.57	78.08	36
2048	222.73	37271.58	167.34	224.22	29716.53	132.53	36
4096	221.65	45108.17	203.51	225.13	38749.31	172.12	36
8192	231.04	52202.33	225.95	236.11	47935.11	203.02	36
16384	221.39	58060.02	262.25	225.95	55937	247.56	36
32768	221.21	63913.48	288.92	225.9	62328.38	275.91	36
65536	221.07	67370.75	304.74	225.76	66826.92	296	36
131072	231.31	62300.79	269.34	225.82	68236.36	302.17	36
262144	217.89	62668.37	287.62	225.09	66128.27	293.78	36
524288	218.	57143.	261.71	224	65669.	293.17	36

	35	58			29		
1048576	215.88	49240.12	228.1	222.61	65609.97	294.73	36
2097152	214.79	45825.1	213.34	220.41	64839.18	294.18	36
1024	221.5	21990.23	99.28	223.68	16534.01	73.92	40
2048	222.56	31191.82	140.15	224.25	25719.57	114.69	40
4096	221.79	45575.61	205.49	224.72	40534.99	180.38	40
8192	167.61	61296.82	365.71	172.71	56932.64	329.65	40
16384	221.49	66136.04	298.6	225.94	62383.64	276.1	40
32768	220.71	69879.59	316.61	225.82	67989.12	301.08	40
65536	174.44	55627.47	318.88	225.65	73072.42	323.83	40
131072	118.05	72099.12	610.75	122.75	75685.66	616.61	40
262144	219.85	71025.73	323.07	224.95	73781.12	327.99	40
524288	219.18	71115.46	324.47	224.45	74043.13	329.89	40
1048576	214.67	60772.4	283.09	222.21	73300.78	329.88	40
2097152	217.1	41709.27	192.12	220.35	71862.13	326.13	40
1024	221.54	20174.53	91.06	223.52	15270.99	68.32	44
2048	222.15	33572.87	151.13	224.28	27317.06	121.8	44
4096	221.73	51439.14	231.99	225.24	43761.66	194.29	44
8192	121.07	63054.43	520.81	133.37	56566.51	424.13	44
16384	221.15	70651.35	319.47	225.97	69810.26	308.93	44
32768	221.07	78624.3	355.65	225.81	76738	339.84	44
65536	221.21	81398.2	367.96	225.79	80146.63	354.95	44
131072	221.1	79445.38	359.32	225.77	82640.92	366.05	44
262144	219.62	78416.21	357.06	224.93	81105.02	360.58	44

524288	218.34	76560.58	350.64	224.5	81222.04	361.8	44
1048576	214.12	64727.35	302.3	221.47	66979.98	302.44	44
2097152	214.71	58216.88	271.15	220.95	79604.06	360.28	44



The Graph here shows that were a number of threads and array size Vs the Speed.

Here we can see that the graph is in an up and down pattern until the graph reache 500,000 after that most of the speed up in almost all the threads becoming in a straight line. I feel this is due to the prefetching