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CS475

Project 6 Write Up

1. What machine you ran this on

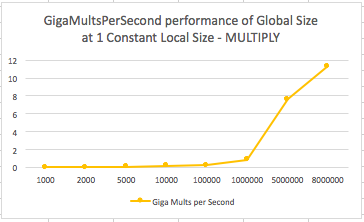
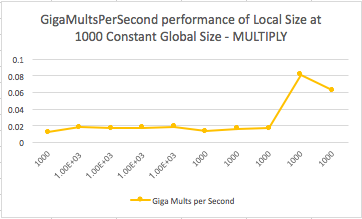
I ran this on Rabbit which 2 E5-2630 Xeon Processors

1. Show the table and graph

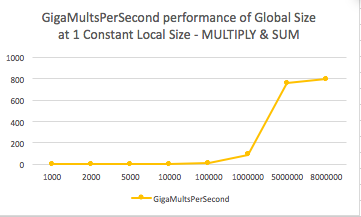
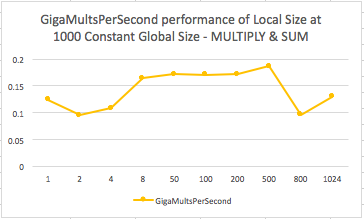
Table at bottom of Write up and in Project6.xlxs excel spread sheet.

Graph

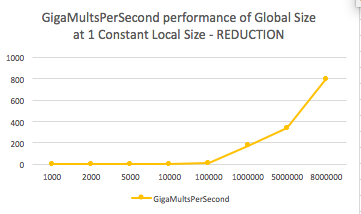
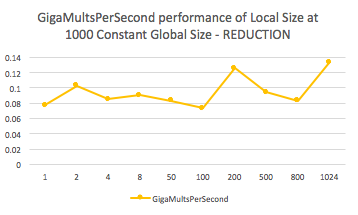
Multiply



Multiply & Sum



Reduction



1. What patterns are you seeing in the performance curves?

With global size constant and local size changing there doesn’t seem to be much of an increase in Giga Mults per second. With local size constant, it looks like there is a sharp increase in Giga Mults Per Second as the Global Size increases. In Reduction the increase doesn’t level out after 8 million where as in multiply and in multiply & sum the Giga Mults per second does level out.

1. Why do you think the patterns look this way?

I believe these patterns are due to the advantage of reduction, in that it will always increase giga mults per second no matter how high a value you choose since there is time being saved using the reduction method and having to do less calculations.

1. What is the performance difference between doing a Multiply and doing a Multiply-Add?

Multiply has much lower Giga mults per second values than Mulitply & Add. With a constant local size of 1 multiply got up to 11 Giga mults per second while Multiply & Add reached 800 Giga mults per second. So, there is a huge difference between the two.

1. What does that mean for the proper use of GPU parallel computing?

For proper use of GPU parallel computing this means that we can still see an increase in Giga mults per second that we would not have seen otherwise. With Reduction the same held true.

**Multiply Table**

|  |  |  |  |
| --- | --- | --- | --- |
| Global Size | Local Size | Work Group Size | GigaMultsPerSecond |
| 1000 | 1 | 1000 | 0.0123197 |
| 1.00E+03 | 2.00E+00 | 500 | 0.0178021 |
| 1.00E+03 | 4.00E+00 | 250 | 0.0171851 |
| 1.00E+03 | 8.00E+00 | 125 | 0.0175633 |
| 1.00E+03 | 5.00E+01 | 20 | 0.0184648 |
| 1000 | 1.00E+02 | 10 | 0.0131387 |
| 1000 | 2.00E+02 | 5 | 0.0162989 |
| 1000 | 5.00E+02 | 2 | 0.0170864 |
| 1000 | 8.00E+02 | 1 | 0.081453 |
| 1000 | 1.02E+03 | 0 | 0.0627353 |
| 2000 | 1.00E+00 | 2000 | 0.0307977 |
| 2000 | 2 | 1000 | 0.0339213 |
| 2000 | 4 | 500 | 0.0304734 |
| 2000 | 8 | 250 | 0.0285413 |
| 2000 | 50 | 40 | 0.0356373 |
| 2000 | 100 | 20 | 0.0336638 |
| 2000 | 200 | 10 | 0.0464005 |
| 2000 | 500 | 4 | 0.0394727 |
| 2000 | 800 | 2 | 0.217179 |
| 2000 | 1024 | 1 | 0.165344 |
| 5000 | 1 | 5000 | 0.0821315 |
| 5000 | 2 | 2500 | 0.0812348 |
| 5000 | 4 | 1250 | 0.0800679 |
| 5000 | 8 | 625 | 0.0847932 |
| 5000 | 50 | 100 | 0.0716435 |
| 5000 | 100 | 50 | 0.0569424 |
| 5000 | 200 | 25 | 0.0873805 |
| 5000 | 500 | 10 | 0.084568 |
| 5000 | 800 | 6 | 0.455705 |
| 5000 | 1024 | 4 | 0.419216 |
| 10000 | 1 | 10000 | 0.176097 |
| 10000 | 2 | 5000 | 0.161186 |
| 10000 | 4 | 2500 | 0.116382 |
| 10000 | 8 | 1250 | 0.153759 |
| 10000 | 50 | 200 | 0.0542841 |
| 10000 | 100 | 100 | 0.16439 |
| 10000 | 200 | 50 | 0.160942 |
| 10000 | 500 | 20 | 0.106586 |
| 10000 | 800 | 12 | 0.576037 |
| 10000 | 1024 | 9 | 0.815195 |
| 100000 | 1 | 100000 | 0.228569 |
| 100000 | 2 | 50000 | 0.00880625 |
| 100000 | 4 | 25000 | 0.176865 |
| 100000 | 8 | 12500 | 0.0775412 |
| 100000 | 50 | 2000 | 0.00969371 |
| 100000 | 100 | 1000 | 0.173016 |
| 100000 | 200 | 500 | 0.179171 |
| 100000 | 500 | 200 | 0.174555 |
| 100000 | 800 | 125 | 0.157813 |
| 100000 | 1024 | 97 | 8.57632 |
| 1000000 | 1 | 1000000 | 0.85283 |
| 1000000 | 2 | 500000 | 0.876548 |
| 1000000 | 4 | 250000 | 0.788719 |
| 1000000 | 8 | 125000 | 1.81068 |
| 1000000 | 50 | 20000 | 0.0980657 |
| 1000000 | 100 | 10000 | 1.33413 |
| 1000000 | 200 | 5000 | 0.0915014 |
| 1000000 | 500 | 2000 | 0.0804581 |
| 1000000 | 800 | 1250 | 1.41752 |
| 1000000 | 1024 | 976 | 100.25 |
| 5000000 | 1 | 5000000 | 7.65157 |
| 5000000 | 2 | 2500000 | 11.9305 |
| 5000000 | 4 | 1250000 | 4.18011 |
| 5000000 | 8 | 625000 | 8.32513 |
| 5000000 | 50 | 100000 | 8.4942 |
| 5000000 | 100 | 50000 | 8.63233 |
| 5000000 | 200 | 25000 | 11.6405 |
| 5000000 | 500 | 10000 | 8.27383 |
| 5000000 | 800 | 6250 | 8.44023 |
| 5000000 | 1024 | 4882 | 410.273 |
| 8000000 | 1 | 8000000 | 11.3269 |
| 8000000 | 2 | 4000000 | 14.08 |
| 8000000 | 4 | 2000000 | 11.6672 |
| 8000000 | 8 | 1000000 | 13.8352 |
| 8000000 | 50 | 160000 | 0.0516821 |
| 8000000 | 100 | 80000 | 12.2147 |
| 8000000 | 200 | 40000 | 0.787309 |
| 8000000 | 500 | 16000 | 11.7276 |
| 8000000 | 800 | 10000 | 2.16258 |
| 8000000 | 1024 | 7812 | 615.858 |
| 1000 | 1 | 1000 | 0.0123197 |
| 2000 | 1.00E+00 | 2000 | 0.0307977 |
| 5000 | 1 | 5000 | 0.0821315 |
| 10000 | 1 | 10000 | 0.176097 |
| 100000 | 1 | 100000 | 0.228569 |
| 1000000 | 1 | 1000000 | 0.85283 |
| 5000000 | 1 | 5000000 | 7.65157 |
| 8000000 | 1 | 8000000 | 11.3269 |

**Multiply & Sum**

|  |  |  |  |
| --- | --- | --- | --- |
| Global Size | Local Size | Work Group Size | GigaMultsPerSecond |
| 1000 | 1 | 1000 | 0.123916 |
| 1000 | 2 | 500 | 0.0953016 |
| 1000 | 4 | 250 | 0.108214 |
| 1000 | 8 | 125 | 0.164772 |
| 1000 | 50 | 20 | 0.171527 |
| 1000 | 100 | 10 | 0.171263 |
| 1000 | 200 | 5 | 0.172355 |
| 1000 | 500 | 2 | 0.186811 |
| 1000 | 800 | 1 | 0.096581 |
| 1000 | 1024 | 0 | 0.130073 |
| 2000 | 1 | 2000 | 0.206015 |
| 2000 | 2 | 1000 | 0.191388 |
| 2000 | 4 | 500 | 0.255037 |
| 2000 | 8 | 250 | 0.349527 |
| 2000 | 50 | 40 | 0.228258 |
| 2000 | 100 | 20 | 0.241167 |
| 2000 | 200 | 10 | 0.276053 |
| 2000 | 500 | 4 | 0.344472 |
| 2000 | 800 | 2 | 0.351494 |
| 2000 | 1024 | 1 | 0.346982 |
| 5000 | 1 | 5000 | 0.475104 |
| 5000 | 2 | 2500 | 0.603137 |
| 5000 | 4 | 1250 | 0.760111 |
| 5000 | 8 | 625 | 0.540775 |
| 5000 | 50 | 100 | 0.617665 |
| 5000 | 100 | 50 | 0.466417 |
| 5000 | 200 | 25 | 0.534702 |
| 5000 | 500 | 10 | 0.77018 |
| 5000 | 800 | 6 | 0.930059 |
| 5000 | 1024 | 4 | 0.467902 |
| 10000 | 1 | 10000 | 1.15141 |
| 10000 | 2 | 5000 | 0.947868 |
| 10000 | 4 | 2500 | 1.49142 |
| 10000 | 8 | 1250 | 1.28651 |
| 10000 | 50 | 200 | 0.973996 |
| 10000 | 100 | 100 | 1.74155 |
| 10000 | 200 | 50 | 1.69491 |
| 10000 | 500 | 20 | 1.7138 |
| 10000 | 800 | 12 | 1.6714 |
| 10000 | 1024 | 9 | 1.86255 |
| 100000 | 1 | 100000 | 12.95 |
| 100000 | 2 | 50000 | 16.818 |
| 100000 | 4 | 25000 | 16.9693 |
| 100000 | 8 | 12500 | 16.8293 |
| 100000 | 50 | 2000 | 14.3021 |
| 100000 | 100 | 1000 | 16.559 |
| 100000 | 200 | 500 | 12.8353 |
| 100000 | 500 | 200 | 12.6968 |
| 100000 | 800 | 125 | 11.2587 |
| 100000 | 1024 | 97 | 9.16338 |
| 1000000 | 1 | 1000000 | 91.0498 |
| 1000000 | 2 | 500000 | 81.3668 |
| 1000000 | 4 | 250000 | 92.9712 |
| 1000000 | 8 | 125000 | 94.4912 |
| 1000000 | 50 | 20000 | 88.4175 |
| 1000000 | 100 | 10000 | 89.7665 |
| 1000000 | 200 | 5000 | 106.44 |
| 1000000 | 500 | 2000 | 108.167 |
| 1000000 | 800 | 1250 | 130.565 |
| 1000000 | 1024 | 976 | 111.894 |
| 5000000 | 1 | 5000000 | 757.69 |
| 5000000 | 2 | 2500000 | 648.76 |
| 5000000 | 4 | 1250000 | 269.775 |
| 5000000 | 8 | 625000 | 643.998 |
| 5000000 | 50 | 100000 | 458.253 |
| 5000000 | 100 | 50000 | 834.169 |
| 5000000 | 200 | 25000 | 469.924 |
| 5000000 | 500 | 10000 | 687.756 |
| 5000000 | 800 | 6250 | 445.752 |
| 5000000 | 1024 | 4882 | 743.164 |
| 8000000 | 1 | 8000000 | 794.202 |
| 8000000 | 2 | 4000000 | 685.519 |
| 8000000 | 4 | 2000000 | 994.036 |
| 8000000 | 8 | 1000000 | 713.011 |
| 8000000 | 50 | 160000 | 670.184 |
| 8000000 | 100 | 80000 | 756.358 |
| 8000000 | 200 | 40000 | 706.527 |
| 8000000 | 500 | 16000 | 989.852 |
| 8000000 | 800 | 10000 | 748.853 |
| 8000000 | 1024 | 7812 | 1415.17 |
| 1000 | 1 | 1000 | 0.123916 |
| 2000 | 1 | 2000 | 0.206015 |
| 5000 | 1 | 5000 | 0.475104 |
| 10000 | 1 | 10000 | 1.15141 |
| 100000 | 1 | 100000 | 12.95 |
| 1000000 | 1 | 1000000 | 91.0498 |
| 5000000 | 1 | 5000000 | 757.69 |
| 8000000 | 1 | 8000000 | 794.202 |

**Reduction**

|  |  |  |  |
| --- | --- | --- | --- |
| Global Size | Local Size | Work Group Size | GigaMultsPerSecond |
| 1000 | 1 | 1000 | 0.0770237 |
| 1000 | 2 | 500 | 0.102522 |
| 1000 | 4 | 250 | 0.0848896 |
| 1000 | 8 | 125 | 0.090555 |
| 1000 | 50 | 20 | 0.083029 |
| 1000 | 100 | 10 | 0.0732976 |
| 1000 | 200 | 5 | 0.125691 |
| 1000 | 500 | 2 | 0.0943397 |
| 1000 | 800 | 1 | 0.0832848 |
| 1000 | 1024 | 0 | 0.133014 |
| 2000 | 1 | 2000 | 0.174474 |
| 2000 | 2 | 1000 | 0.178571 |
| 2000 | 4 | 500 | 0.188982 |
| 2000 | 8 | 250 | 0.318166 |
| 2000 | 50 | 40 | 0.187021 |
| 2000 | 100 | 20 | 0.190513 |
| 2000 | 200 | 10 | 0.198275 |
| 2000 | 500 | 4 | 0.180783 |
| 2000 | 800 | 2 | 0.190968 |
| 2000 | 1024 | 1 | 0.246123 |
| 5000 | 1 | 5000 | 0.29656 |
| 5000 | 2 | 2500 | 0.801794 |
| 5000 | 4 | 1250 | 0.469926 |
| 5000 | 8 | 625 | 0.467726 |
| 5000 | 50 | 100 | 0.431667 |
| 5000 | 100 | 50 | 0.412677 |
| 5000 | 200 | 25 | 0.461808 |
| 5000 | 500 | 10 | 0.467858 |
| 5000 | 800 | 6 | 0.801281 |
| 5000 | 1024 | 4 | 0.461127 |
| 10000 | 1 | 10000 | 1.14417 |
| 10000 | 2 | 5000 | 0.936067 |
| 10000 | 4 | 2500 | 0.909091 |
| 10000 | 8 | 1250 | 1.1192 |
| 10000 | 50 | 200 | 0.876423 |
| 10000 | 100 | 100 | 0.875657 |
| 10000 | 200 | 50 | 0.941618 |
| 10000 | 500 | 20 | 0.876423 |
| 10000 | 800 | 12 | 0.847457 |
| 10000 | 1024 | 9 | 0.901144 |
| 100000 | 1 | 100000 | 8.81057 |
| 100000 | 2 | 50000 | 8.41468 |
| 100000 | 4 | 25000 | 9.43397 |
| 100000 | 8 | 12500 | 9.46072 |
| 100000 | 50 | 2000 | 8.75655 |
| 100000 | 100 | 1000 | 9.88727 |
| 100000 | 200 | 500 | 9.16252 |
| 100000 | 500 | 200 | 9.29367 |
| 100000 | 800 | 125 | 5.88028 |
| 100000 | 1024 | 97 | 9.28504 |
| 1000000 | 1 | 1000000 | 175.963 |
| 1000000 | 2 | 500000 | 96.0617 |
| 1000000 | 4 | 250000 | 94.518 |
| 1000000 | 8 | 125000 | 97.0875 |
| 1000000 | 50 | 20000 | 96.2741 |
| 1000000 | 100 | 10000 | 102.554 |
| 1000000 | 200 | 5000 | 53.3419 |
| 1000000 | 500 | 2000 | 50.7537 |
| 1000000 | 800 | 1250 | 98.6972 |
| 1000000 | 1024 | 976 | 55.991 |
| 5000000 | 1 | 5000000 | 339.512 |
| 5000000 | 2 | 2500000 | 452.734 |
| 5000000 | 4 | 1250000 | 808.145 |
| 5000000 | 8 | 625000 | 469.175 |
| 5000000 | 50 | 100000 | 552.914 |
| 5000000 | 100 | 50000 | 462.236 |
| 5000000 | 200 | 25000 | 233.852 |
| 5000000 | 500 | 10000 | 10417.1 |
| 5000000 | 800 | 6250 | 425.64 |
| 5000000 | 1024 | 4882 | 455.913 |
| 8000000 | 1 | 8000000 | 796.018 |
| 8000000 | 2 | 4000000 | 762.848 |
| 8000000 | 4 | 2000000 | 686.284 |
| 8000000 | 8 | 1000000 | 732.398 |
| 8000000 | 50 | 160000 | 724.44 |
| 8000000 | 100 | 80000 | 717.489 |
| 8000000 | 200 | 40000 | 761.397 |
| 8000000 | 500 | 16000 | 729.926 |
| 8000000 | 800 | 10000 | 695.652 |
| 8000000 | 1024 | 7812 | 714.477 |
| 1000 | 1 | 1000 | 0.0770237 |
| 2000 | 1 | 2000 | 0.174474 |
| 5000 | 1 | 5000 | 0.29656 |
| 10000 | 1 | 10000 | 1.14417 |
| 100000 | 1 | 100000 | 8.81057 |
| 1000000 | 1 | 1000000 | 175.963 |
| 5000000 | 1 | 5000000 | 339.512 |
| 8000000 | 1 | 8000000 | 796.018 |