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CS 475 Parallel Programming
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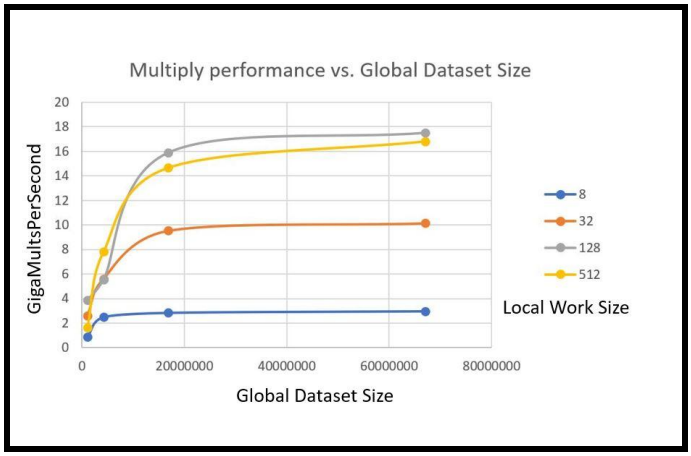
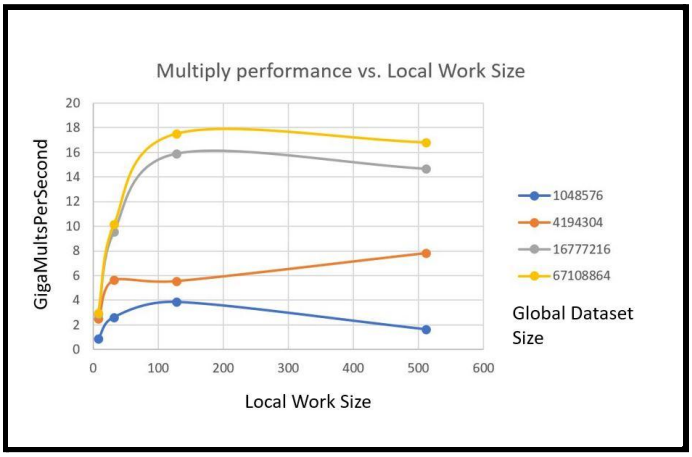
Project #6: OpenCL Array Multiply, Multiply-Add, and Multiply-Reduce

1. What machine you ran this on
    - Rabbit
2. Show the tables and graphs

    Multiply Table and Graphs:

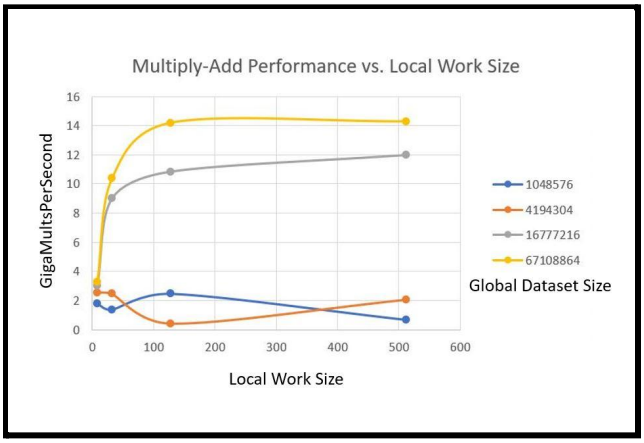
NMB	Local Work Size	Global Dataset Size	GigaMultsPerSec
1	8	1048576	0.884
1	32	1048576	2.624
1	128	1048576	3.86
1	512	1048576	1.651
4	8	4194304	2.491
4	32	4194304	5.621
4	128	4194304	5.544
4	512	4194304	7.811
16	8	16777216	2.85
16	32	16777216	9.526
16	128	16777216	15.886
16	512	16777216	14.655
64	8	67108864	2.979
64	32	67108864	10.138
64	128	67108864	17.518
64	512	67108864	16.815

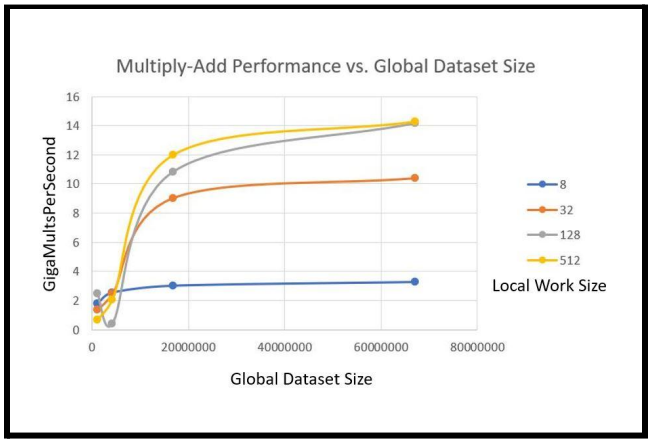

Multiply performance vs. Global Dataset Size
GigaMultsPerSecond
20
18
16
14
12
10
8
6
4
2
0
0
20000000
40000000
60000000
80000000
Global Dataset Size
8
32
128
512
Local Work Size


Multiply performance vs. Local Work Size
GigaMultsPerSecond
20
18
16
14
12
10
8
6
4
2
0
0
100
200
300
400
500
600
Local Work Size
1048576
4194304
16777216
67108864
Global Dataset Size

Multiply-Add Table and Graphs:

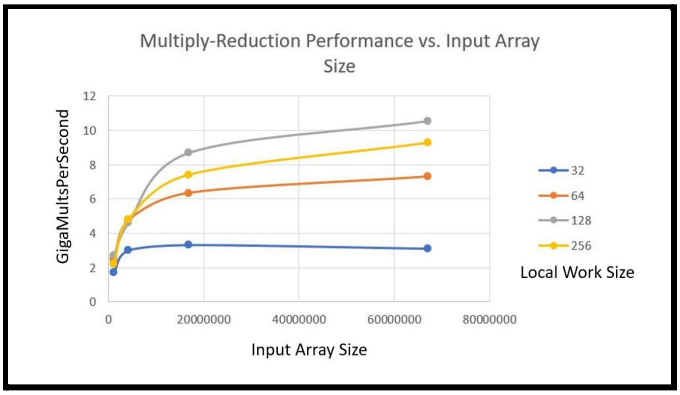
NMB	Local Work Size	Global Dataset Size	GigaMultsPerSec
1	8	1048576	1.778
1	32	1048576	1.369
1	128	1048576	2.471
1	512	1048576	0.654
4	8	4194304	2.555
4	32	4194304	2.457
4	128	4194304	0.405
4	512	4194304	2.067
16	8	16777216	3.029
16	32	16777216	9.013
16	128	16777216	10.841
16	512	16777216	11.98
64	8	67108864	3.288
64	32	67108864	10.38
64	128	67108864	14.188
64	512	67108864	14.278





Multiply-Reduce Table and Graphs:

NMB	Local Work Size	Input Array Size	GigaMultsPerSec
1	32	1048576	1.718
1	64	1048576	2.494
1	128	1048576	2.705
1	256	1048576	2.207
4	32	4194304	3.006
4	64	4194304	4.775
4	128	4194304	4.613
4	256	4194304	4.82
16	32	16777216	3.32
16	64	16777216	6.351
16	128	16777216	8.685
16	256	16777216	7.405
64	32	67108864	3.109
64	64	67108864	7.3
64	128	67108864	10.545
64	256	67108864	9.271



3. What patterns are you seeing in the performance curves?
    - The Multiply and Multiply-Add performance graphs appear to follow a logarithmic curve. For both Multiply and Multiply-Add graphs, the performance appears to increase with both increasing Global Dataset Size and increasing Local Work Size.
    - The Multiply-Reduce performance graph also appears to follow a logarithmic curve. It appears that as the Input Array Size increases, the GigaMultsPerSecond also increases.
4. Why do you think the patterns look this way?
    - I think the patterns look this way because the larger global dataset/input array size implies that the system has to do more GigaMultsPerSecond

than compared with a smaller global dataset size. Moreover, the same is with larger local work sizes. The larger the local work size is, the more work can be assigned to each compute unit.

5. What is the performance difference between doing a Multiply and doing a Multiply-Add?
    - Multiply appears to be slightly faster than Multiply-Add, with the highest recorded performance for Multiply being approximately 3.5 GigaMultsPerSecond faster than that of Multiply-Add.
6. What does that mean for the proper use of GPU parallel computing?
    - I believe this means that on a practical level, increasing the local work size and increasing the global dataset size in general increases the level of performance that GPUs can offer for computing data streams.