

## CS 575 Project #6 OpenCL Linear Regression

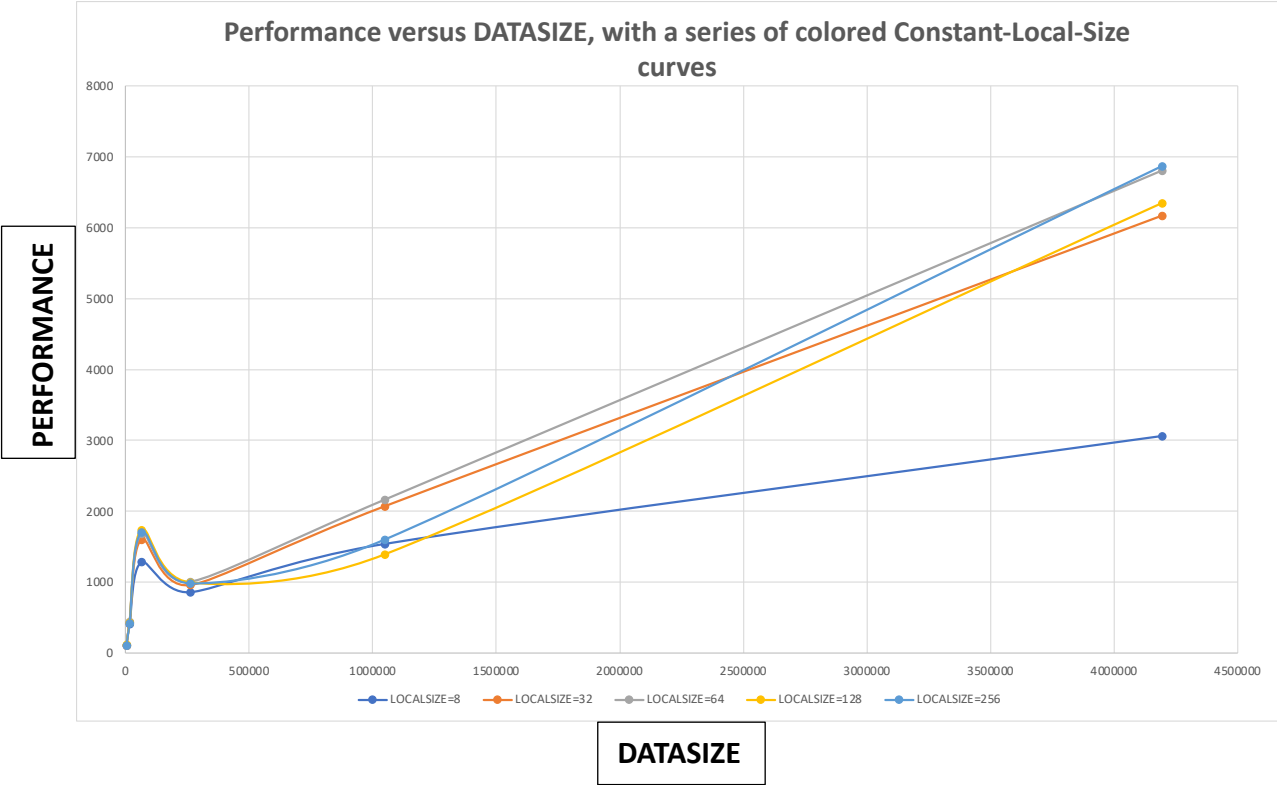
### 1. What machine you ran this on

→ DGX Machine

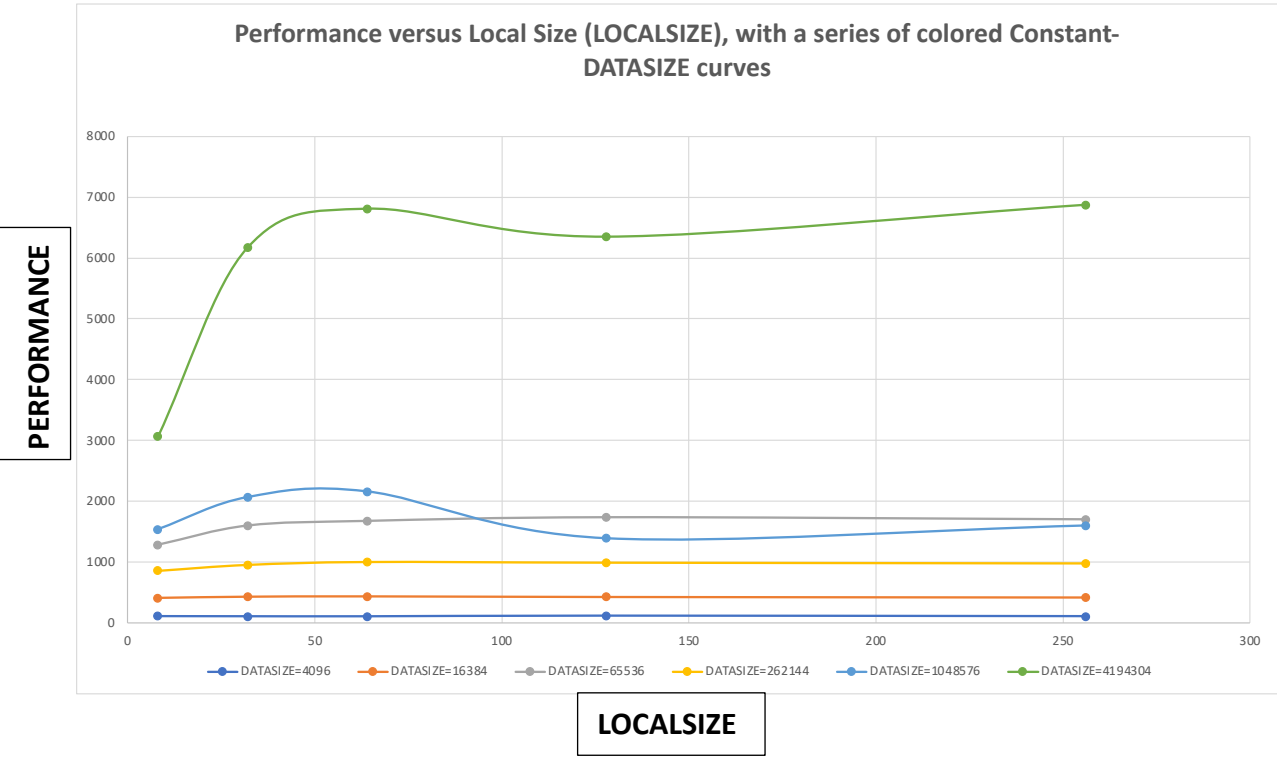
### 2. Show the table and graphs

DATASIZE	LOCALSIZE	Performance (MegaPointsProcessedPerSecond)	M	B
4096	8	105.99	5	6.99
4096	32	104.03	5	6.99
4096	64	103.33	5	6.99
4096	128	113.91	5	6.99
4096	256	105.59	5	6.99
16384	8	409.09	5	7
16384	32	429.33	5	7
16384	64	434.98	5	7
16384	128	424.25	5	7
16384	256	415.3	5	7
65536	8	1280.81	5	7
65536	32	1598.6	5	7
65536	64	1674.97	5	7
65536	128	1735.7	5	7
65536	256	1701.37	5	7
262144	8	855.27	5	7
262144	32	953.97	5	7
262144	64	1001.95	5	7
262144	128	991.04	5	7
262144	256	978.89	5	7
1048576	8	1537.24	5	7
1048576	32	2066.64	5	7
1048576	64	2159.01	5	7
1048576	128	1386.8	5	7
1048576	256	1597.4	5	7
4194304	8	3061.33	5.01	7
4194304	32	6169.74	5.01	7
4194304	64	6806.36	5.01	7
4194304	128	6346.93	5.01	7
4194304	256	6870.52	5.01	7

1. Performance versus DATASIZE, with a series of colored Constant-Local-Size curves



2. Performance versus Local Size (LOCALSIZE), with a series of colored Constant-DATASIZE curves



### 3. What patterns are you seeing in the performance curves? What difference does the size of data make? What difference does the size of each work-group make?

- **Performance vs DATASIZE:** As DATASIZE increases, performance generally increases for each LOCALSIZE, with the highest performances seen at the largest DATASIZE.
- **Performance vs LOCALSIZE:** Performance peaks at certain LOCALSIZE values (typically around 64 or 128) and then decreases slightly or stabilizes.

**Difference made by the size of data:** Larger DATASIZE generally results in better utilization of the GPU, leading to higher performance. The performance improvement is more noticeable for larger LOCALSIZE values.

**Difference made by the size of each work-group:** Optimal LOCALSIZE can significantly impact performance. Too small or too large LOCALSIZE can lead to suboptimal performance. LOCALSIZE around 64 to 128 tends to give the best performance for most DATASIZE values.

### 4. Why do you think the patterns look this way?

The patterns can be attributed to the following factors:

- **GPU Utilization:** Larger DATASIZE means more work for the GPU, leading to better utilization and reduced idle time, which results in higher performance.
- **Work-group Efficiency:** LOCALSIZE affects how work is divided among GPU cores. There is a balance between too few and too many work-items in a work-group. An optimal LOCALSIZE ensures efficient parallel execution and memory access patterns.
- **Memory Access Patterns:** Larger LOCALSIZE can lead to better memory coalescing and fewer memory access overheads, but if too large, it can cause contention and reduce performance.
- **Kernel Execution:** The efficiency of kernel execution can vary with the number of work-items. Finding the optimal LOCALSIZE ensures that the kernel execution is balanced and efficient.

### 5. Determining the M and B for the Line Equation

→ From the values of the table above, on average  $m = 5$  and  $b = 7$ .