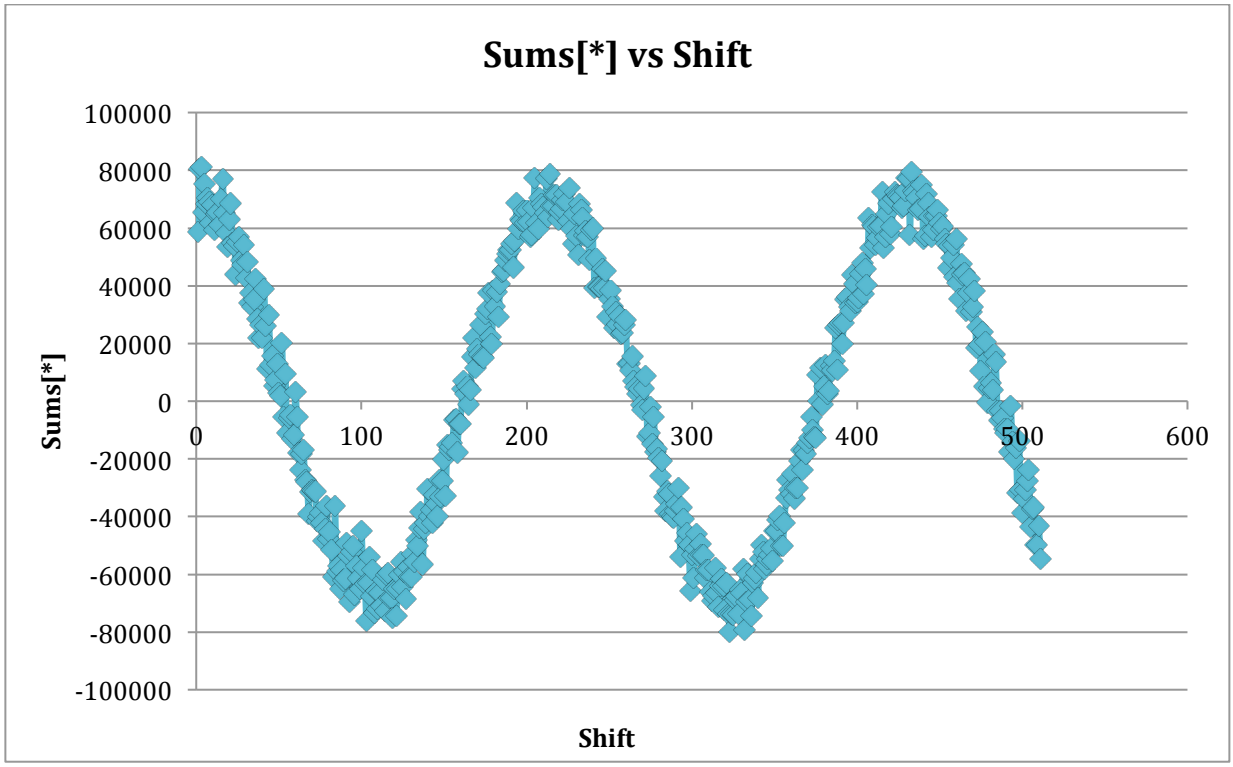
Project 7B: OpenMP, OpenCL, SIMD

1. **What machines you ran this on.**

   I ran the OpenMP code on Flip server. The SIMD and OpenCL were run on rabbit server.

2. **Show the Sums{1] ... Sums[512] vs. shift scatterplot.**



3. **State what the hidden sine-wave period is, i.e., at what multiples of *shift* are you seeing maxima in the graph?**

   The hidden sine wave period is approximately **200**, as can be observed from the above graph. This signifies that every maxima of this sine wave occurs after the regular intervals of 200 shifts.

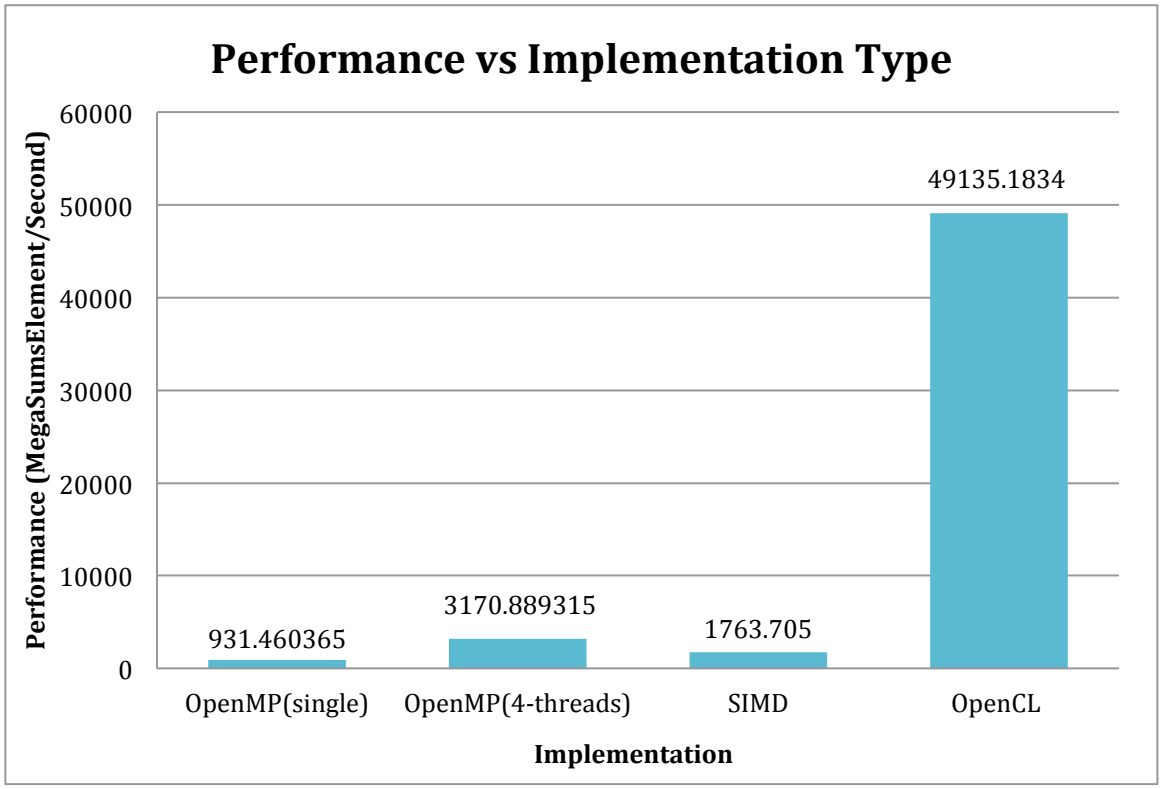
4. **What patterns are you seeing in the performance bar chart? Which of the four tests runs fastest, next fastest, etc.? By a little, or by a lot?**

   The following observations can be made from the below bar chart:

1. **OpenMP (single, 4-threads):** The performance of 4-threaded OpenMP performs better than the SIMD, and can be stated as the next best option to OpenCL. However, the performance of OpenCL is much higher than OpenMP single or multiple threaded implementations. As a matter of fact, the performance of the single threaded OpenMP is the worst of all the options present in the bar plot.

2. **SIMD:** The performance of SIMD seems better than the single threaded OpenMP implementation. However, multiple threaded implementation of OpenMP beats SIMD in performance by a significant margin.

3. **OpenCL:** With the use of GPU, OpenCL performs the best as the processing of data is done by GPU and hence outperforms all the other implementation types.



5. **Why do you think the performances work this way?**

The very high performance of of OpenCL is expected as it uses GPU to process the data and all other implementations make use of the

CPU. Due to the maximum parallelism provided by GPU, the performance can be seem to have increased exponentially in comparison to others.

Four threaded OpenMP would any day outperform single threaded OpenMP. It makes use of more threads allowing more parallelism. However, it's a good observation that it also outperformed SIMD. This is because the speedup obtained using SIMD would only be 4times however the speedup for 4-threaded OpenMP would be much higher than SIMD.

SIMD performed better than single threaded OpenMP as mentioned above, the speedup of SIMD would be almost 4 times. However, the latter would not be able to provide this kind of speedup.