f) In a couple sentences, explain the difference that you see in the times for mmul1, mmul2 and mmul3 *when running on an Euler compute node*. What would explain the performance results you report? Be as specific as possible. Also comment on the difference or similarity you see between mmul1 and mmul4.

The result I got:

1024

3772.04 (mmul1)

-6.05257

540.708 (mmul2)

-6.05257

9992.26 (mmul3)

-6.05257

3597.87 (mmul4)

-6.05257

The main cause of the difference of time between mmul1, mmul2, and mmul3 is the way we access the memory. For mmul2, we are accessing it in the most sequential way, leading to the least amount of time spent. For mmul3, it is the opposite. We go through the matrix column by column, causing poor locality and thus long execution time.

For mmul1 and mmul4, the difference of time is not significant. I think the reason is because even though the underlying data structure is not the same, with one using array and the other vector, they are both accessing the data in the same way.