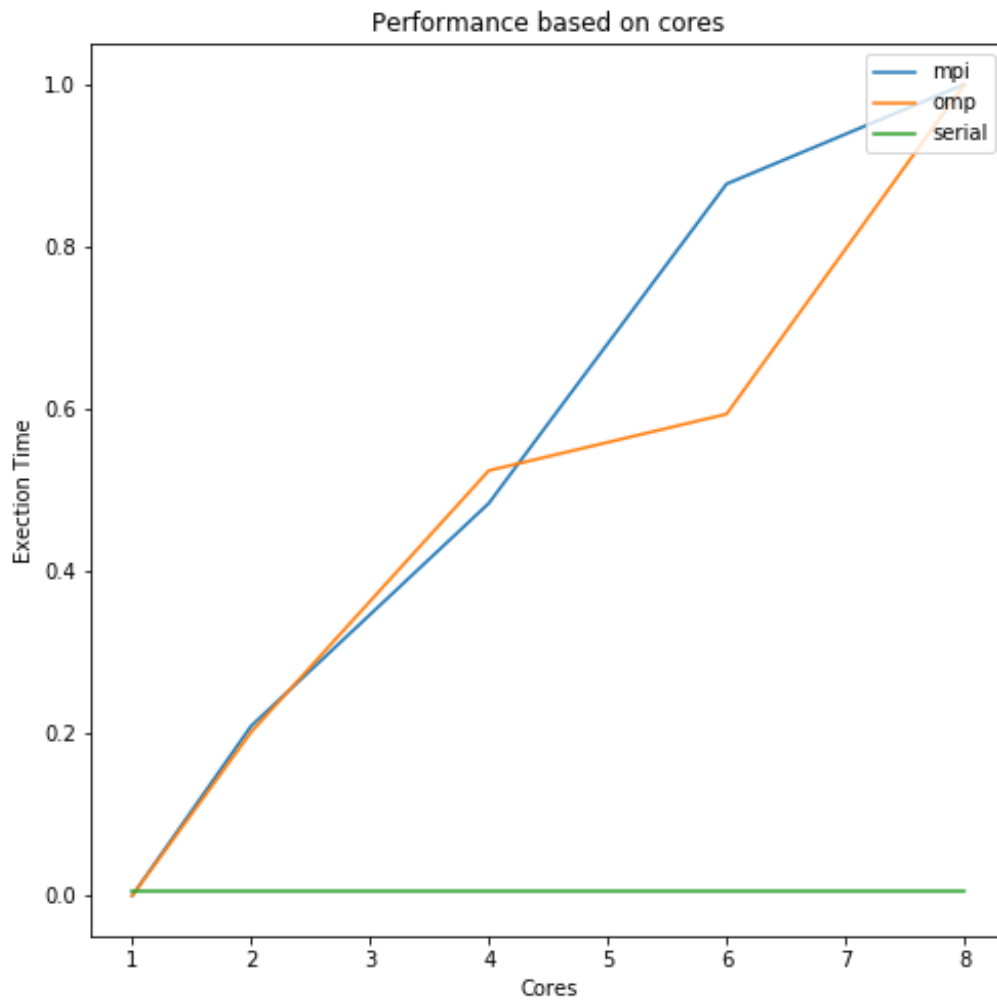


# Assignment 1

Execution times on different number of cores using 3 methods (all in seconds):

Cores	MPI	OpenMP	Serial
1	0.000000	0.001328	0.004859
2	0.064913	0.002428	0.004859
4	0.150190	0.004188	0.004859
6	0.272410	0.004568	0.004859
8	0.310506	0.006786	0.004859



1. The **mm\_serial.c** file gives constant execution time since we are not configuring any CPU cores for it. It gives a constant time as given in the above table under the **Serial** column. The time is calculated in seconds.
2. The **mm\_mpi.c** file can be configured to be run on different CPU cores as given by the command given below:

**mpirun --np 4 --mca btl ^openib --oversubscribe ./mm\_mpi**

The execution time increases as cores increase which is controlled by the `--np` parameter. This is because of the fact that our computational task at hand is very small (multiplying small matrices) and hence more cores adds additional overhead for transferring data on multiple cores and threads.

3. The **mm\_omp.c** file can be configured to be run by setting the **OMP\_NUM\_THREADS** environment variable. This variable controls number of cores to allocate for the OpenMP program to run. Here too, the execution time increase as the cores increase due to small computational task.

NOTE: For the above analysis, the MPI program does not run on 1 core since it requires a minimum of 2 cores. As a result the observation of 1 core is put as 0. Likewise, since the execution time varied from seconds to microseconds based on cores and techniques, the above values given in the table were normalized before plotting on the graph.