High Performance Computing
Homework 12

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For this assignment the **main_program.py** file was modified to implement a **raw kernel** from **Cupy** to fill a matrix, K, of size NxN, with the specifications provided in assignment 12. A vector, f, of size N, was also created using Cupy's zeros function. Cupy's linear solver, **cupy.linalg.solve()**, was used to obtain the solution of the system Kf = u. This same procedure was replicated using only **Numpy** functions. The execution time was measured in both approaches, from the moment the matrices and vectors were created, to the moment in which the solution vector was printed. The results from both runs were saved in the **results.txt** file. A summary of these results may be observed in Table 1.

Table 1. Results from the Numpy and Cupy implementations.

Approach	Execution Time [s]	Speed Up
Numpy	13.180090	1
Cupy	4.492181	2.93400689

The results show an increased efficiency in the **Cupy** run, which is almost 3X faster than the **Numpy** implementation. These results clearly show the advantages of using GPUs for fine-grained applications such is the case of filling-up a matrix.