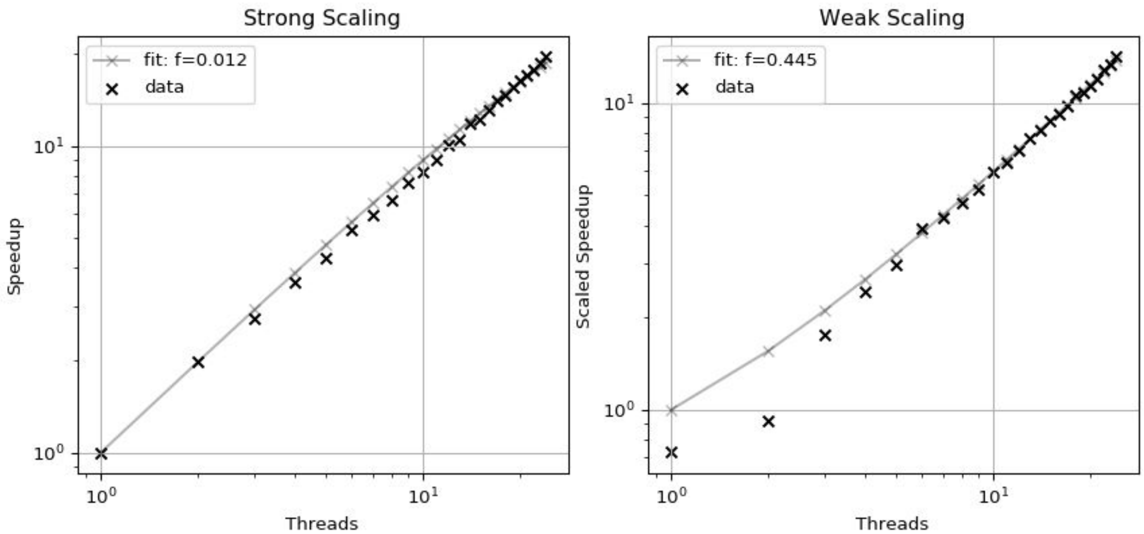
Step 5 Report

Performance measurements were taken using Hamilton. Since both Amdahl's Strong Scaling and Gustafson's Weak Scaling laws ignore some concurrency overhead that scales with the number of threads, we only collect performance information for up to 24 threads*. Both graphs are presented below:



Both models fit the experimental behaviour of our program quite well. For strong scaling, we used a problem size of 2449 particles, and derived that $f = 0.012$. For weak scaling, we found $f = 0.445$ but had to scale the number of particles n such that the number of threads $p \propto \sqrt{n}$, since our simulation needs $O(n^2)$ force computations per iteration. The problem size was increased from 500 to 7053 particles.

The weak scaling graph fitting our results so well is unexpected, because we couldn't ensure that each core is doing an equal amount of work due to the way we parallelised our program - each thread would need to run against n other particles, rather than distribute all force computations equally amongst all cores. Thus we conclude with the previous reasoning and experimental evidence, both above and below that the strong scaling model fits our program better.

*: For both weak and strong scaling models, their speedup laws break down when we exceed the number of real cores on a node, although we note that the strong scaling graph still fits better: