

# Assignment MPI: Numerical Integration : Manager-Worker

The purpose of this assignment is for you to learn more about

- implementing a dynamic workload partitioning scheme in MPI (here Manager-Worker).
- implementing operations using regular communication patterns.

As usual all time measurements are to be performed on the cluster.

## 1 Numerical Integration : Manager-Worker (35 pts)

A manager-worker system enables dynamic scheduling of applications. The idea is that one of the MPI processes (the manager, usually rank 0) will be responsible for giving work to the other MPI processes (the worker, usually all the other ones) and collect results from them.

The manager process starts by sending one chunk of work to all the workers. When one of the worker provides the result of that chunk of work, the manager process will send a new chunk of work to the worker that just completed the work.

The workers will wait for a chunk of work to perform, perform that chunk of work, and return the result to the manager node.

Pay attention that the manager node needs to notify the worker nodes when there is no more work to perform so the workers can quit gracefully. (Maybe by sending a message formatted differently, maybe using a different tag.)

**Question:** Adapt the numerical integration to make it schedule the calculation using a manager-worker system. Write that code in `manager_worker/mpi_manager_worker.cpp`. Use a granularity (size of the chunk) that you deem appropriate. You can test your code on your local system with `make test`.

**Question:** Run and time that program on Centaurus and compute speedup. Use the `make bench` and `make plot` scripts to do so.