

# MSc in High Performance Computing

## Coursework for Threaded Programming Part 1

The object of this assessment is to experiment with the loop scheduling options in OpenMP. You will be required to conduct some experiments, and submit a report detailing the results of these experiments, as well as the source code you have written.

You are provided with a piece of code which contains two loops which you should parallelise with OpenMP directives. The code measures the execution time for 1000 repetitions of each loop, and includes a verification test for each loop.

The code can be found on the course pages on Learn. You may choose to work with `c/11loops.c` or Fortran 90 `loops.f90` version.

You should use the Intel compiler, and always compile the code with the `-O3` option to ensure a high level of sequential optimisation, but you must **not** alter any of the code, except to add the OpenMP directives.

### Parallelisation

Add OpenMP directives to parallelise the loops in the routines `loop1` and `loop2`. You should parallelise only the outermost loop in each case.

### SCHEDULE clause options

Once you have parallelised the loops, run the code on 4 threads on the back end of `cirrus`, using the following SCHEDULE clause options:

- `STATIC`
- `AUTO`
- `STATIC, $n$`
- `DYNAMIC, $n$`
- `GUIDED, $n$`

where for the latter three cases,  $n$  (the chunksize) takes the values 1, 2, 4, 8, 16, 32, 64. From these experiments, determine for each loop the best scheduling option on 4 threads. Using this option (which may be different for the two loops), run the code on 1, 2, 4, 6, 8, 12 and 16 threads.

## Submission

You are required to submit the following:

1. A written report.  
(Guideline length: 6-8 pages including figures.)
2. Source code.

The deadline for both report and source code is 16:00 on Friday 25th October 2019.  
Your report should contain:

- a *very short* introduction;
- graphs of the execution time of each loop versus the chunksize for the STATIC,  $n$ , DYNAMIC,  $n$  and GUIDED,  $n$  schedules.
- graphs of the speedup ( $T_1/T_p$ ) for each loop using the best schedule versus number of threads.
- some text describing *and explaining* the results you obtained;
- some *brief* conclusions.

You should *not* include any background material in your report. Your source code submission should contain the parallel version of the code, using the *best scheduling option for each loop on 4 threads*.

The maximum available mark for this assessment is **30**. Marks will be allocated as follows:

- Report content and presentation out of **27**.
- Source code out of **3**.