



PH504 Exam

ICHEC

Deadline: 9th June 2020 at 14:00

1 Introduction

Please carry out all sections and document the code with appropriate comments.

The exam should be your own work. Marks will be deducted if there is copying between students or from online sources.

Please upload the source code and files to BlackBoard by the deadline.

1. Download the program stub `quartile.c` or `quartile.f90` from BrightSpace and complete the code.
2. The program generates an array *arr* of random numbers.
3. The *quartile* function uses a brute force method to find the 1st quartile without sorting the array.
4. You can follow the comments in the function to setup the conditions when the quartile is found.
5. At this point you can exit the loop and return its value.
6. Parallelise this code using OpenMP directives and also parallelise it using MPI functions.

Some general points: for OMP version:

- Do not parallelise the outer loop which takes each element in the array, which is the reference number.
- Parallelise the inner loop that checks all the other numbers against this reference.
- Think carefully about where you define the parallel region.
- When the quartile is found (and there will always be at least one) break out of the outer loop.
- Ensure you are not breaking out of the parallel region, that would be bad practise.

Some general points about MPI version:

- For this version each rank will examine a segment of the larger array *arr*.
- Each rank will need the full array to determine the quartile. Broadcast the array from rank 0 to the other ranks.
- You can alter the arguments for the *quartile* function if you wish.
- Probably only a single rank will find the quartile. Gather the results from all ranks to rank 0 and determine the actual value.

Some more general points:

- It is understood that you may have poor internet. The files that you need to upload and download are quite small.
- You may wish to upload several versions over the course of the exam.
- Weighting will be considered is the proper use and form of directives/functions and the logic and flow of code is correct.
- Good luck!