Parallel Computer Systems, Spring 2022
Instructions for Databar Exercise 4:
Introduction to OpenMP

September 23, 2022

1 Introduction

You will start exploring OpenMP and continue working with our calc program.

Read through the instructions in entirely before starting working.

You document the work, and answers to the questions, in this exercise in the second mandatory, and individual, report with up to 1 pages of text.

2 Learning objectives

During this assignment you will be working towards the following learning objectives:

- You can write down in text and in your own words definitions or explanations of the following concepts: multi-core system; mutual exclusion; race condition; lock; barrier; shared memory model.
- Use OpenMP to write race free parallel programs using shared memory

3 Report and rules

You will have to hand in written reports during the course. The reports should describe the assignments you have completed. Begin writing on the report as early as possible. You should also maintain a progress diary!

DTU has a zero tolerance policy on cheating and plagiarism. This also extends to the report and indeed all your work. To copy text passages or source code from someone else without clearly and properly citing your source is considered plagiarism. See the study hand book for further detail.

4 Reference material

Before carrying out the exercise study chapter 6 and 7 in Heger & Wellein.

5 Setting up the system

You will use the HPC machines for these exercises.

6 Working on the exercise

We will continue to work on our calc program. We are to write a parallel OpenMP version of it.

Run your resulting code on different number of threads, up to 16 threads, and produce a plot of speedup versus number of threads up to 16 threads. For each point what efficiency do you get? What do you think are the underlying overheads leading to the efficiency. Optimize your code to reach the highest possible speedup.

Hint: The examples in Heger & Wellein on how to run OpenMP programs apply to the HPC machines too! Use the `-fopenmp` compiler option when compiling to enable OpenMP.

Hint 2: Once you have run `linuxsh` in a terminal window on the HPC machines, you can run multi-threaded OpenMP programs. There is generally no need to claim a cluster node for OpenMP unless you see a large amount of contention.

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