23rd Summer School on PARALLEL COMPUTING

OpenMP Exercises

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Warm-up with OpenMP

Basic skills

1. Write a serial "Hello world!"
2. Add OpenMP directives to have each thread prompt his greeting
3. Add a conditionally compiled header to show if OpenMP was enabled
4. Experiment with the OMP_NUM_THREADS environment variable

Loop and loop scheduling

1. Write a program to replicate the scheduling plot seen in the lecture
2. Construct a $n_{\text{threads}} \times n_{\text{iterations}}$ matrix to log who executed what
3. Write the information to the ASCII file `IterationMap.txt`
4. Use the script `draw.sh` to plot your results

The everyday duty

Code parallelization

1. Parallelize the serial code `pi.c` that computes the value of π
2. Parallelize the serial code `laplace.c` that solves a $2D$ Laplace equation
   - start with an incremental approach
   - try to include the while loop inside the parallel region

Bug busting

1. Find and correct the bugs in the sample programs
2. Try to explain what was causing the incorrect behavior

Fibonacci with task

The Fibonacci Sequence is the series of numbers:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

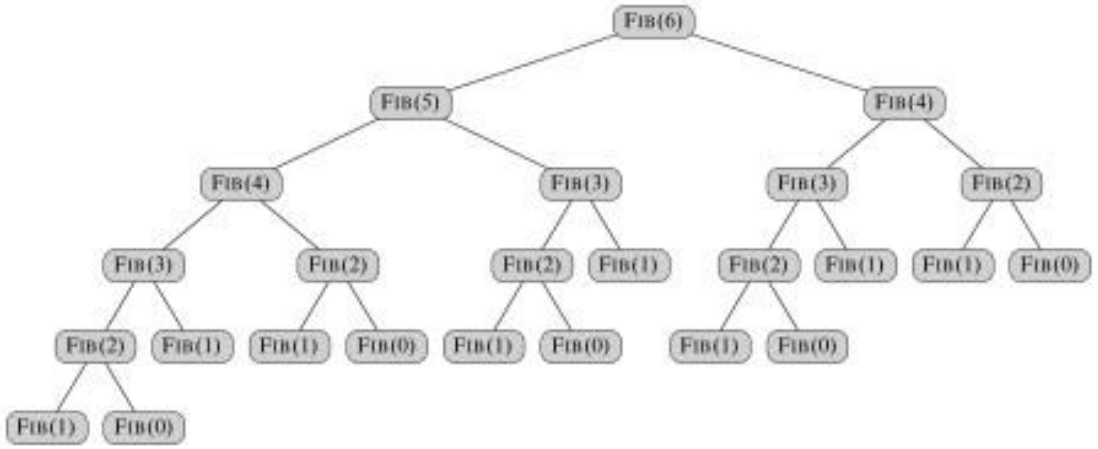
The next number is found by adding up the two numbers before it.

The source code “fibonacci.c” or “fibonacci.f90” compute the Fibonacci sequence in a serial way using a recursive function.

Try to parallelize the code using OpenMP directives

Check speed-up up to 8 threads computing for example fib(40). It’s near to ideal speed-up? If not try to think about a possible optimization strategy.

Hint : try to reduce the number of tasks created at the low levels of the recursive tree



The insane teaser

Who am I (without library calls)?

1. Write an implementation for the two prototype functions:
   - `int get_num_threads()`
   - `int get_thread_id()`
2. You can't use library calls or explicit locks
3. The implementation must work for nested parallel regions
4. You can use all the directives you want
5. Thread ID must be consistent with the OpenMP library

Hints

1. Write first an implementation that works for a single level of parallelism
2. Exploit data sharing attributes to exchange information between threads
3. Remember where barriers are implied