

CompSci 590.03: Introduction to Parallel Computing

Homework 4 - Fork-Join Pattern (10/05/15)

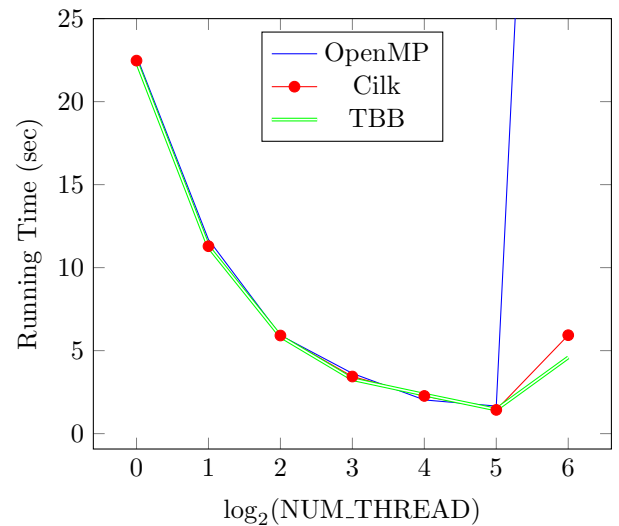
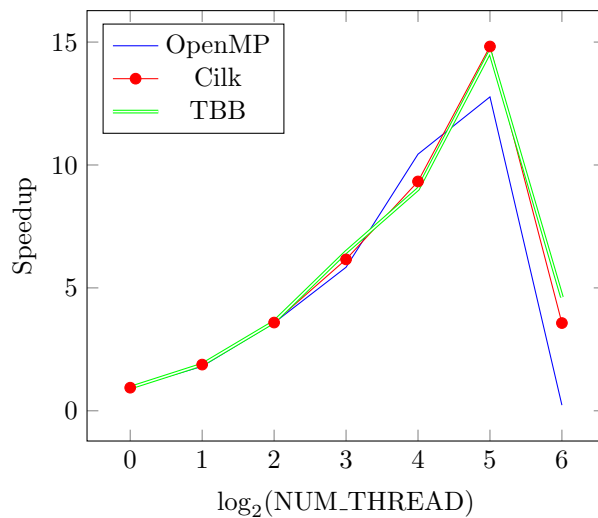
Lecturer: Alvin R. Lebeck

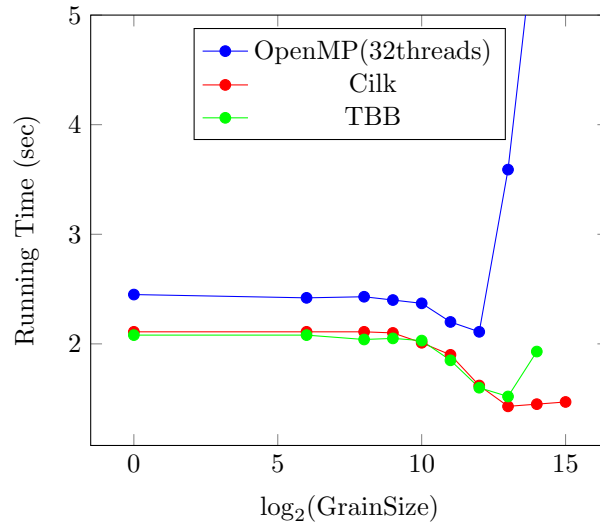
Scribes: Mengke Lian, Kai Fan, Chaoren Liu

Contribution distribution:

- Mengke Lian: Implement forkjoin pattern for OpenMP, Cilk and TBB.
- Kai Fan: Implement fork join pattern for OpenMp, Cilk and TBB, and consider two control variables: grain size and number of workers.
- Chaoren Liu: Implement fork join pattern with Cilk, which decreases the computational time to 1.4s.

The provided serial code for running the Carter particle simulation is about 21.19s. The curves for OpenMP, Cilk and TBB program are shown below:





Discussion

For the simulation, there are 200 particles emitted from each of the four locations, and every particle has time step 10000. Say the 800 initial particles as root particles. For each time step of each particle, the particle is possible to split a new particle with same remaining time step. Thus, each root particle generates a 'family tree' randomly.

Among different root particles, we can use map pattern to implement the parallelism. For one root particle, forkjoin pattern is used to parallelize the process on different branches.

The grain size is also need to tune. We only consider size 2^k , $k = 0, \dots, 14$ (2^{15} for Cilk). According to the result, OpenMp performs best with grain size 4096, while the other two performs best with 8192. In addition, if the grain size is less than 512, this variable has no significant influence for all programs. In general, Cilk and TBB have similar performance, but both better than OpenMp.