Vienna University of Technology

184.725 High Performance Computing

TU Wien Informatics

Exercise 2

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Abstract

Here documented the results of exercise 2, the Programming part of High Performance Computing.

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1 Exercise 1 - Implement A Benchmark Framework

1.1 $\sum_{i=0}^{d} k^i \quad \text{for}\, k > 0$ (Ex1.1)

$$
\begin{aligned}
\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i \\
\sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i \\
\sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i - \sum_{i=1}^{d+1} k^i \\
\sum_{i=0}^{d} k^i\,(1-k) &= 1 - k^{d+1} \\
\sum_{i=0}^{d} k^i &= \frac{k^{d+1}-1}{k-1}
\end{aligned} \tag{1}
$$

2 Exercise 2 - Implement Linear Pipeline for `MPI_Bcast` and `MPI_Reduce`

Text for Ex2.

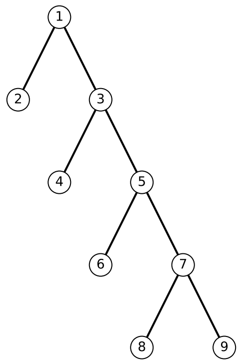

Figure 1: Complete (but unbalanced) binary tree of height $d = 4$ with $p = 9$ nodes.

3 Exercise 3 - Combining `MPI` Processes

Text for Ex3.

4 Exercise 4 - Binary Tree Algorithms for `MPI_Bcast` and `MPI_Reduce`

Text for Ex4.

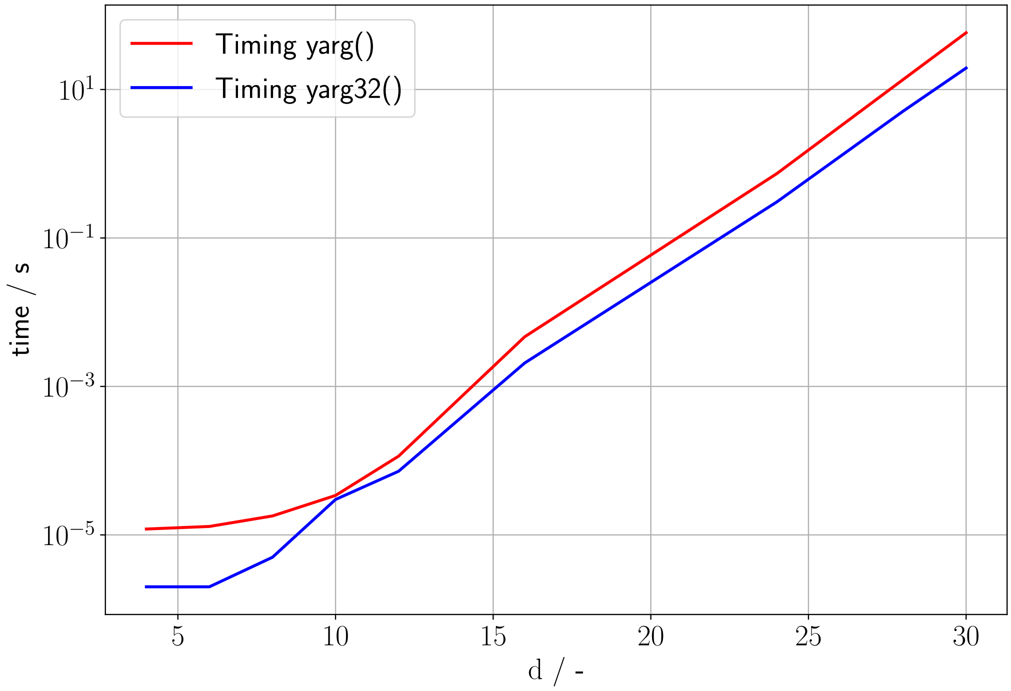

Figure 2: Benchmark both algorithms - `yarg32()` is faster than `yarg()` for all feasible values of d

5 Exercise 5 - Integrated, Improved Binary Tree Algorithm

Text for Ex5.

$$\begin{aligned}
\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i \\
\sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i \\
\sum_{i=0}^{d} k^i - k\sum_{i=0}^{d} k^i &= \sum_{i=0}^{d} k^i - \sum_{i=1}^{d+1} k^i \\
\sum_{i=0}^{d} k^i \left(1-k\right) &= 1 - k^{d+1} \\
\sum_{i=0}^{d} k^i &= \frac{k^{d+1}-1}{k-1}
\end{aligned} \tag{2}$$

6 Exercise 6 - Improvement with Sibling Leave Communication (BONUS)

Text for Ex6.

7 Exercise 7 - Implemenetation and Benchmarking of Improved Version (BONUS)

Text for Ex7.