Comparison of IPC and Parallel Computation Techniques

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N = 216951 (last 6 digits), M = 7 (sum of digits % 6 + 4).

This report compares the performance and structure of four computation methods.

1. Serial Computation

Executes all calculations in a single process, one by one. Simple but does not leverage multiple CPU cores.

2. Fork + File IO

Uses multiple processes (via fork). Each writes results to a binary file. The parent process reads them back. Better parallelism than serial but file IO adds delay.

3. Fork + Shared Memory

Processes write results directly into a shared memory segment. No need for disk IO. Faster and more efficient, but requires careful memory management.

4. Pthreads

Threads work in the same address space and write to a shared array. Fastest method due to low overhead. Best for multi-core systems with proper thread synchronization.

Comparison Table

Method	Speed	Complexity	Notes
Serial	Slow	Simple	Good for small data, baseline
Fork + File	Faster	Complex (files)	Better than serial, IO overhead
Fork + Shared	Fast	Medium	Efficient, but needs careful memory use
Pthreads	Best	Medium	Fastest, optimal on multi-core CPUs

Execution Results

Execution results from the program run:

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- Serial Computation Time: 0.003344 seconds
- Fork with File IO Time: 0.002039 seconds
- Fork with Shared Memory Time: 0.001601 seconds
- Pthreads Time: 0.001182 seconds

All results are identical. Pthreads showed the best performance.