1. Strong scalability experiment results

Strong Scalability
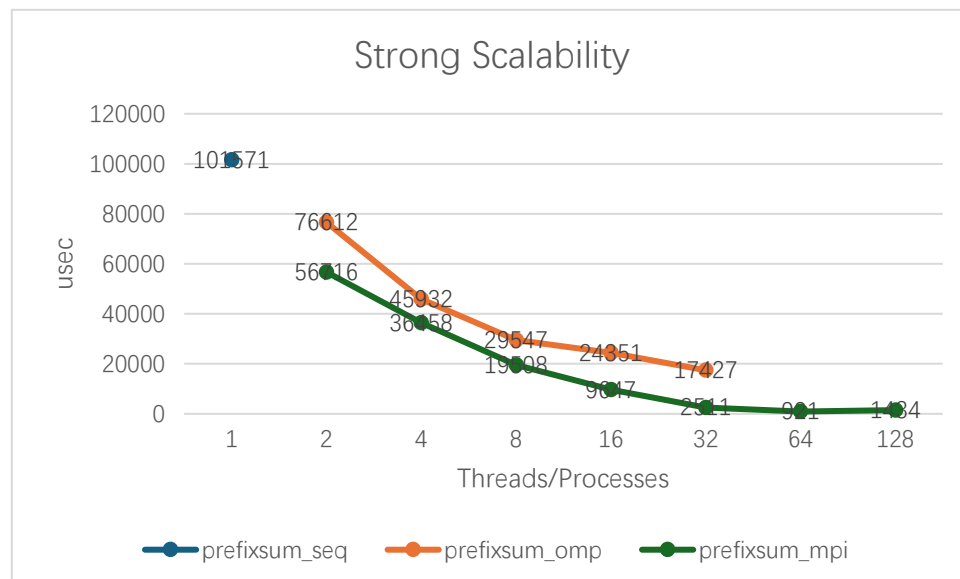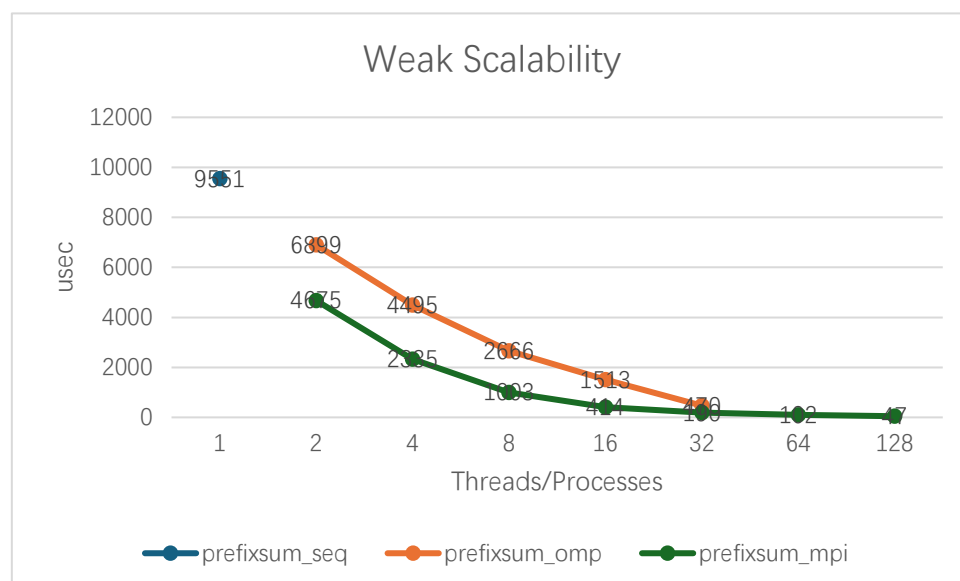

2. Weak scalability experiment results

Weak Scalability

3. Analysis and Conclusion

The approach using OpenMP for communication through shared memory can effectively accelerate the parallelization of the prefix sum task. Since no barriers or locks are used, the execution time decreases almost linearly as the number of threads increases under weak scalability. However, under strong scalability, the performance bottleneck shifts to the single-

thread processing capability, so increasing the number of threads no longer results in a linear decrease in processing time. The MPI parallel approach, which uses message passing for communication, achieves a highly noticeable linear speedup when the number of cores is not too large. However, as the number of cores increases, the speedup tends to flatten. This may be due to too many cores being distributed across different computing nodes, with communication between them relying on the network. Even though the HPC at the school adopts the Infiniband high-performance network communication standard and the code uses a binary tree for communication to reduce the number of communications, the communication time and frequency between cores increase significantly as the number of cores increases.