Homework2

Analysis

Q1: Which do you think is better? (Intern Block or Intern Cyclic?) Why? Which intern do you offer a full-time job?

I think Intern Cyclic is better. Because of using cyclic distribution, the workload assigned to each processor is more evenly distributed. If using block distribution, some blocks in the image may require a lot of computation while others require much less, resulting in some processors having much longer running time and reducing the overall efficiency of the algorithm.

Q2: Analyze the speedup and efficiency of the two approaches against provided serial version.

As shown in the experimental data in the appendix, I recorded the time for different processors and algorithms under the same width and height, and calculated their speedup using serial algorithm as the baseline. It can be seen that as the number of processors increases, the speedup of the three algorithms increases. As the width and height increase, the speedup of the three algorithms also increases. I think this is because as the computation increases, the proportion of communication overhead decreases, so the parallel effect becomes more significant. Among them, the coordinator/worker algorithm has the highest efficiency.

Q3: Compare the coordinator/worker strategy with Cyclic/Block's implementation. Which do you think will scale to very large image sizes? Why?

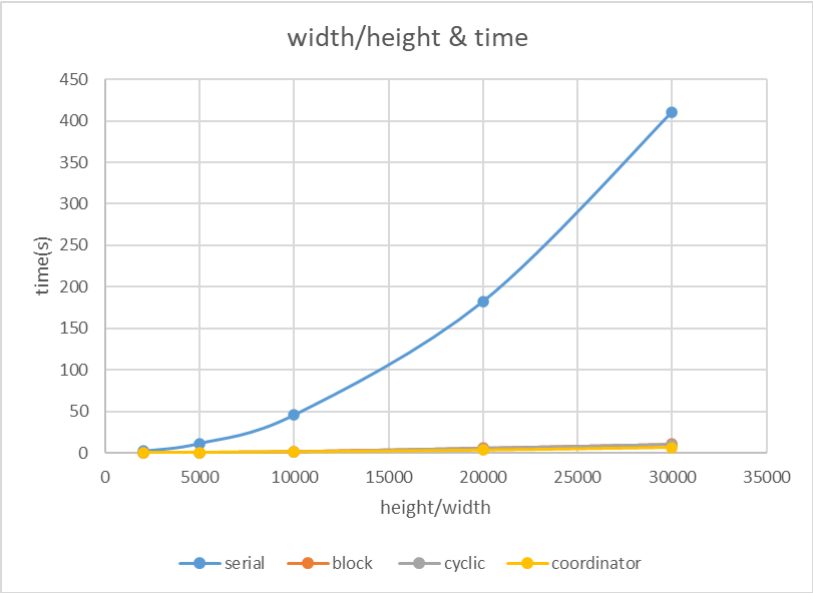
I believe that the coordinator/worker algorithm will scale well to very large image sizes. This is because the coordinator/worker pattern can better balance the workload of each processor. Moreover, in the case of large image sizes, communication time becomes less important and load balancing becomes more important. Compared to cyclic and serial algorithms, coordinator/worker can maximize the workload balance of each processor. From the experimental data, it can also be seen that coordinator/worker performs better for large image sizes.

Experimental data

size = 160

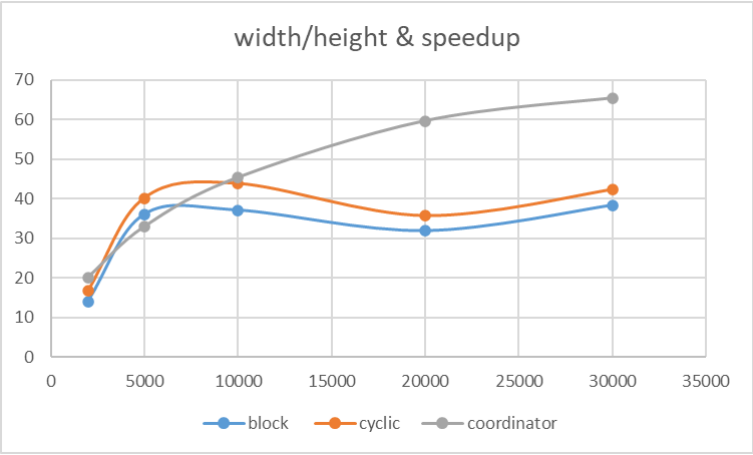
time:

n	serial	block	cyclic	coordinator
2000	1.827	0.129621	0.109066	0.090443
5000	11.409	0.316418	0.283988	0.346204
10000	45.616	1.227557	1.039772	1.006156
20000	182.402	5.712387	5.099455	3.05863
30000	410.603	10.69449	9.701577	6.279263



speedup

n	serial	block	cyclic	coordinator
2000	1	14.09494	16.75132	20.200568
5000	1	36.05674	40.17423	32.954559
10000	1	37.15999	43.87116	45.336906
20000	1	31.93096	35.76892	59.635196
30000	1	38.39387	42.32333	65.390317

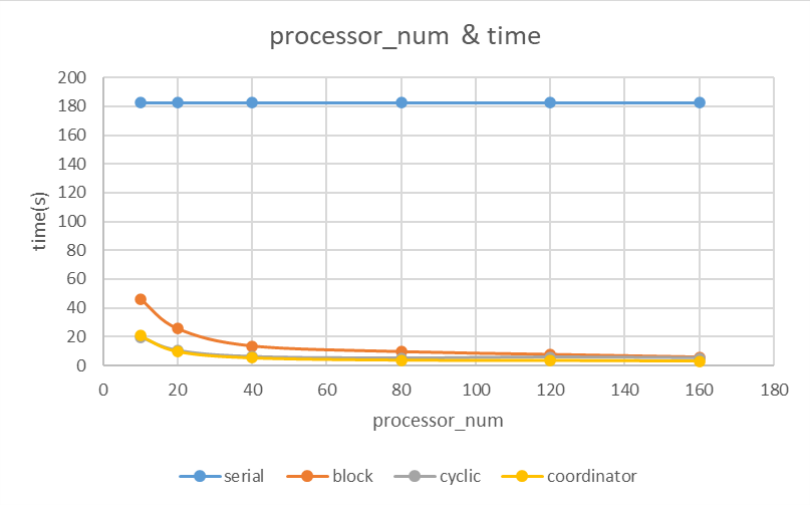


width=height=20000

time

size	serial	block	cyclic	coordinator
10	182.402	46.32251	19.67729	20.783252
20	182.402	25.60703	10.34035	9.820045
40	182.402	13.48371	5.970255	5.304041

size	serial	block	cyclic	coordinator
80	182.402	9.513813	4.908937	3.69
120	182.402	7.575961	5.672071	3.510274
160	182.402	5.712387	5.099455	3.05863



speedup

size	serial	block	cyclic	coordinator
10	1	3.937654	9.269673	8.7763936
20	1	7.123121	17.63984	18.574457
40	1	13.52759	30.55179	34.389252
80	1	19.17233	37.15713	49.431436
120	1	24.07642	32.15792	51.962325
160	1	31.93096	35.76892	59.635196