2021

Assignment 3

PARALLEL SORTING USING MPI

COL 730

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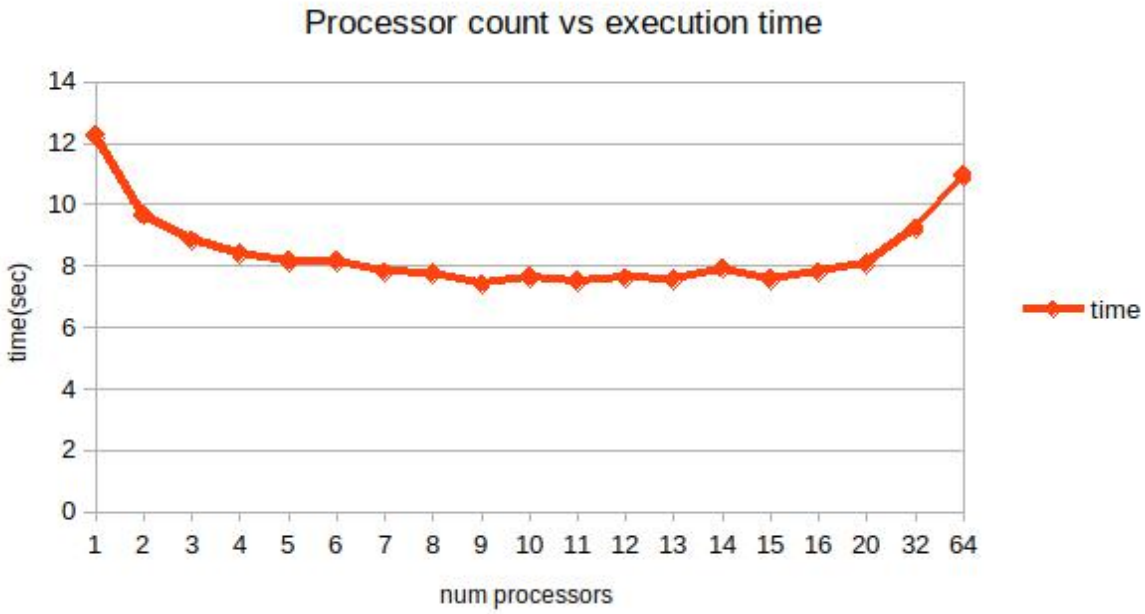
Processor count vs Execution time graph

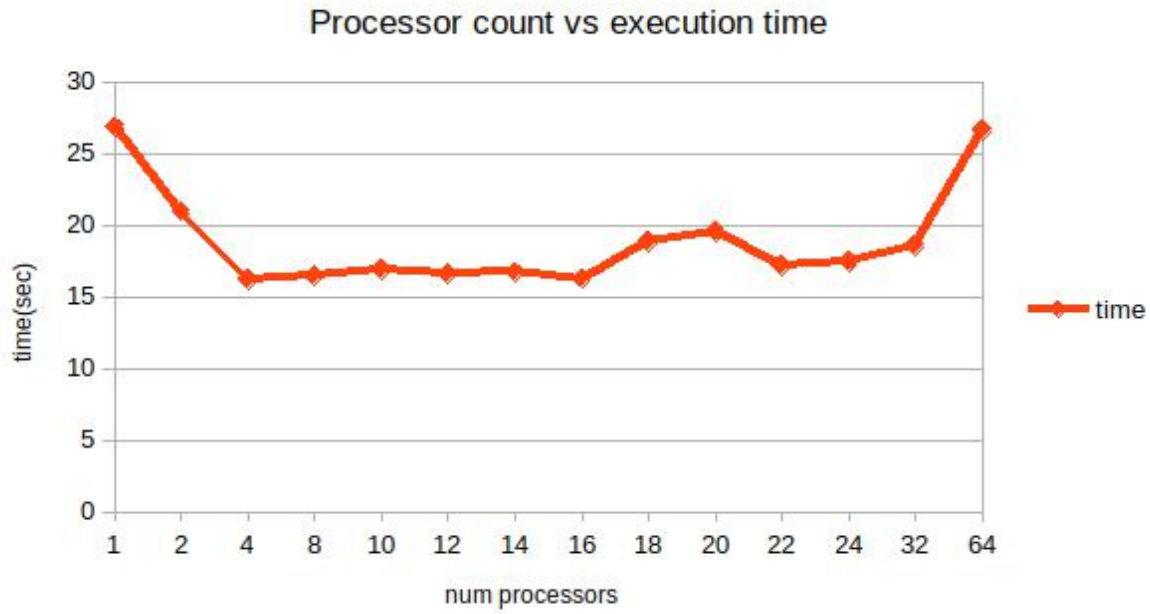
Experiment 1

size	nproc	time(sec)
10000000	1	12.224
10000000	2	9.665
10000000	3	8.841
10000000	4	8.394
10000000	5	8.134
10000000	6	8.141
10000000	7	7.792
10000000	8	7.765
10000000	9	7.403
10000000	10	7.616
10000000	11	7.488
10000000	12	7.612
10000000	13	7.569
10000000	14	7.906
10000000	15	7.565
10000000	16	7.805
10000000	20	8.077
10000000	32	9.225
10000000	64	10.928



Experiment 2

size	nproc	time(sec)
20000000	1	26.864
20000000	2	20.97
20000000	4	16.185
20000000	8	16.464
20000000	10	16.928
20000000	12	16.597
20000000	14	16.728
20000000	16	16.24
20000000	18	18.856
20000000	20	19.569
20000000	22	17.205
20000000	24	17.488
20000000	32	18.584
20000000	64	26.63



Approach/ Algorithm used

- Designed parallelized version of quick sort
- **Why not merge sort**? Started with merge sort but thought it would require a lot of message passing and a lot of auxiliary memory creation required
- Parallelized quick sort:
    - Step 1: Message passing (all gather) between processors how many elements each has.
    - Step 2: Processor 1 sends pivot element to each processor(MPI_Isend, MPI_recv)
    - Step 3: Each processor divides itself into 2 parts left(containing items < pivot) and right(containing items >=pivot)
    - Step 4: Message passing to other processors that how many elements smaller than pivot are present with itself
    - Step 5: Processors compute whether they are left, right or pivot processors themselves; and start sending elements between each other swapping elements to get to a state where there are first all elements less than pivot then all with values more than pivot.
    - Step 6: pace pivot at the correct place by message passing to correct processor
    - Step 7: do recursive call on left and right arrays of pivot.

Time analysis

- Time decreases with increase in number of processors , then becomes constant and after that it starts increasing again as the amount of communication between processors increases.
- This changes with amount of data with each processor as can be seen in the 2 experiments getting trough of minimum at different locations(9,4).