Problem Set 1

CSCE 735 Parallel Computing

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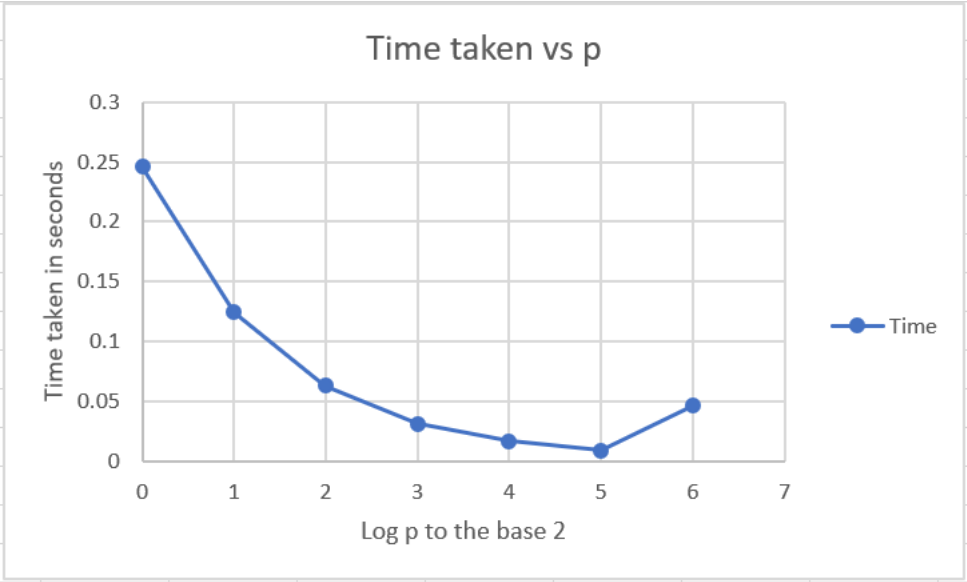
Resources. (All people, books, articles, web pages, etc. that have been consulted when producing your answers to this homework)

On my honor, as an Aggie, I have neither given nor received any unauthorized aid on any portion of the academic work included in this assignment. Furthermore, I have disclosed all resources (people, books, web sites, etc.) that have been used to prepare this homework.

Signature: Vedangi Vivek Bengali

Problem 1. (20 Points) Plot execution time versus p to demonstrate how time varies with the number of processes. Use a logarithmic scale for the x-axis.

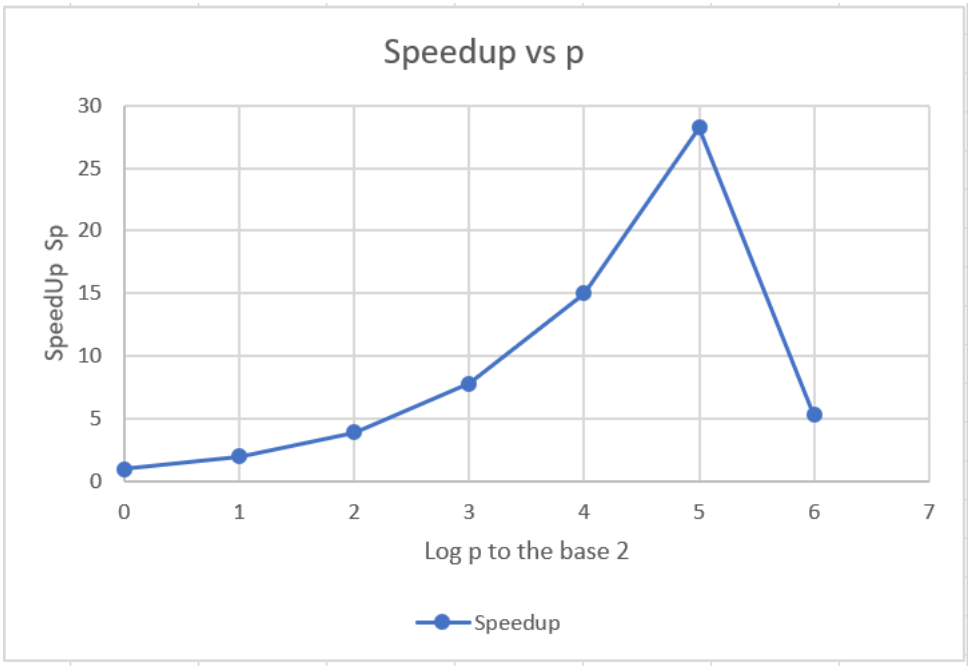
Solution. The graph for Time taken vs Log p is:



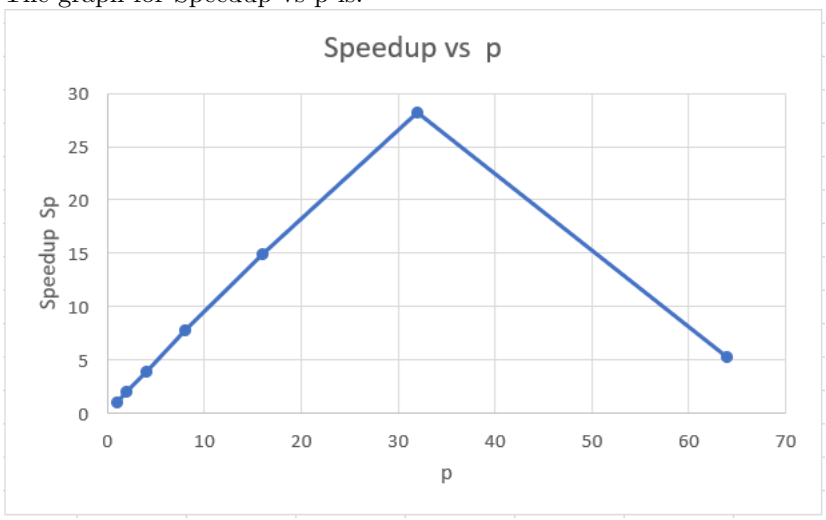
We see here that as p increases, the time taken decreases and it is least at p=32.

Problem 2. (20 points) Plot speedup versus p to demonstrate the change in speedup with p.

Solution. The graph for Speedup vs Log p is:



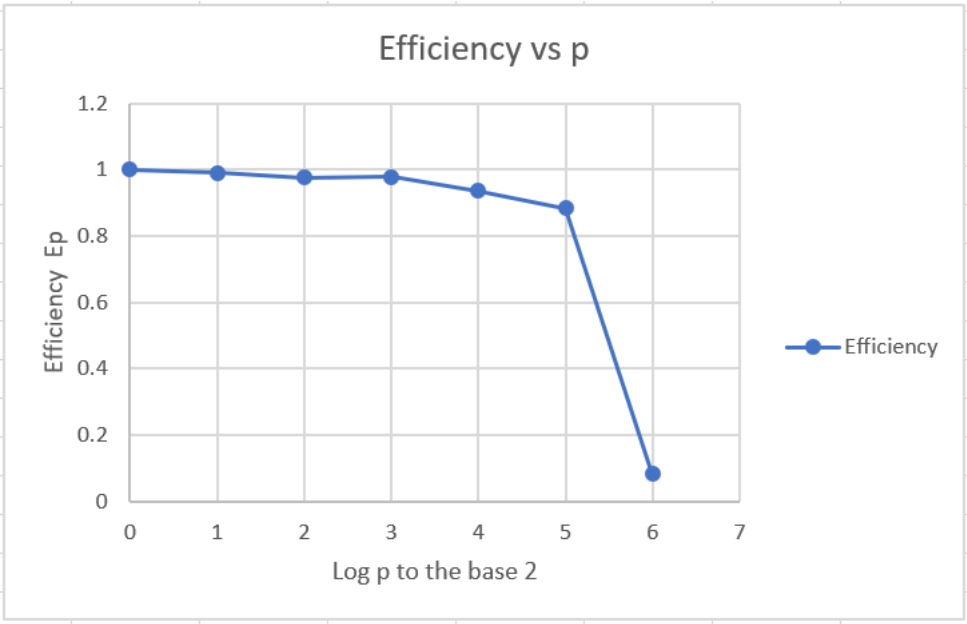
The graph for Speedup vs p is:



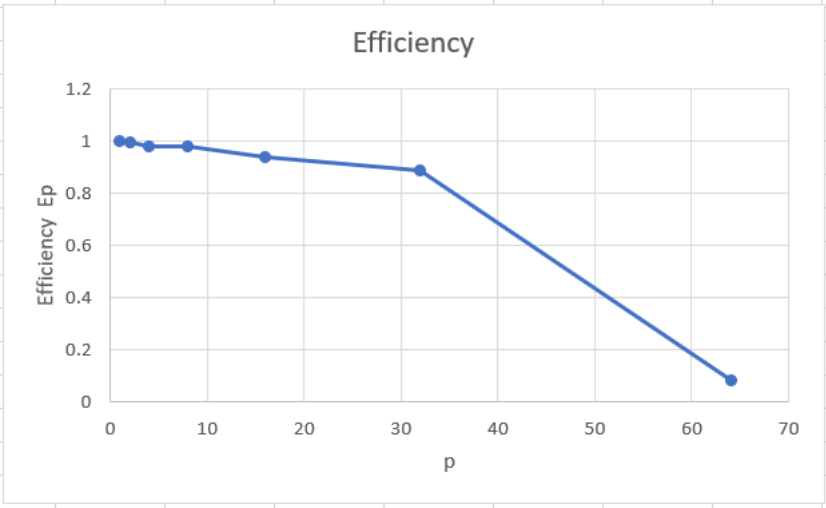
Here, the speedup is maximum for p=32.

Problem 3. (10 points) Using the definition: efficiency = speedup/p, plot efficiency versus p to demonstrate how efficiency changes as the number of processes is increased.

Solution. The graph for Efficiency vs Log p is:



Graph for Efficiency vs p:



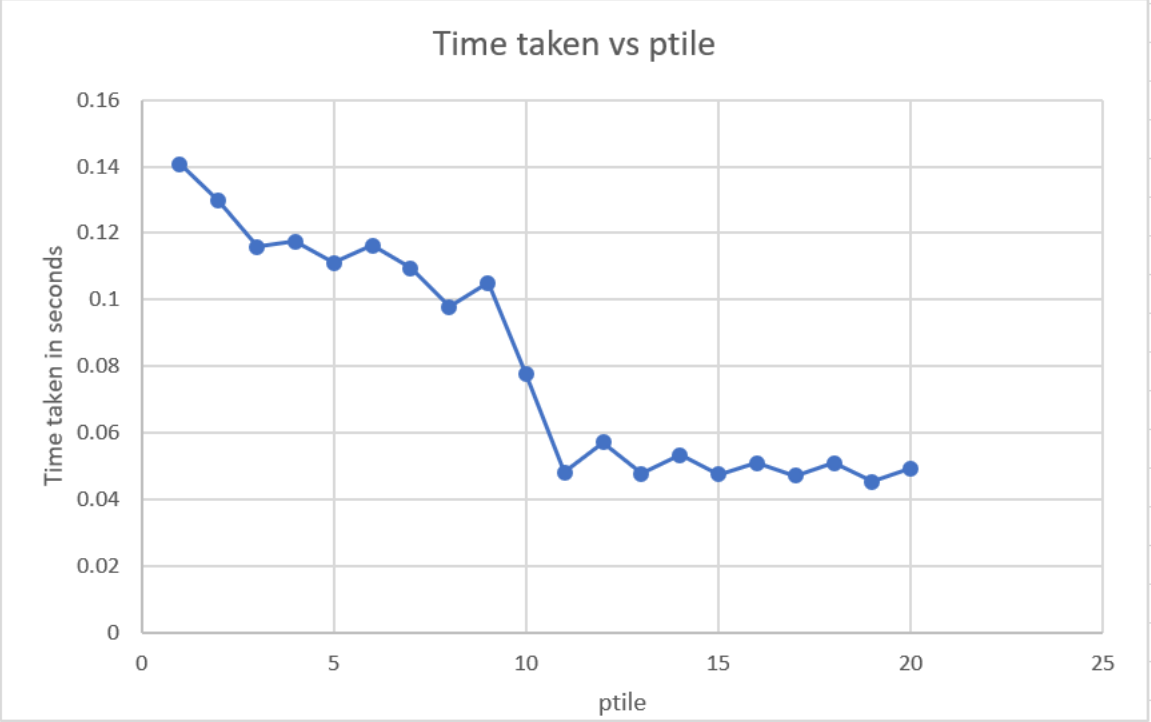
Efficiency goes on decreasing as p increases at a comparatively slower rate till p=32 and drops significantly at p=64.

Problem 4. What value of p minimizes the parallel runtime?

Solution. p=32 Minimizes the Parallel runtime

Problem 5. (20 points) With n = 10^9 and p=64, determine the value of ptile that minimizes the total time. Plot time versus ptile to illustrate your experimental results for this question.

Solution. Ptile = 19 minimizes the total time taken.



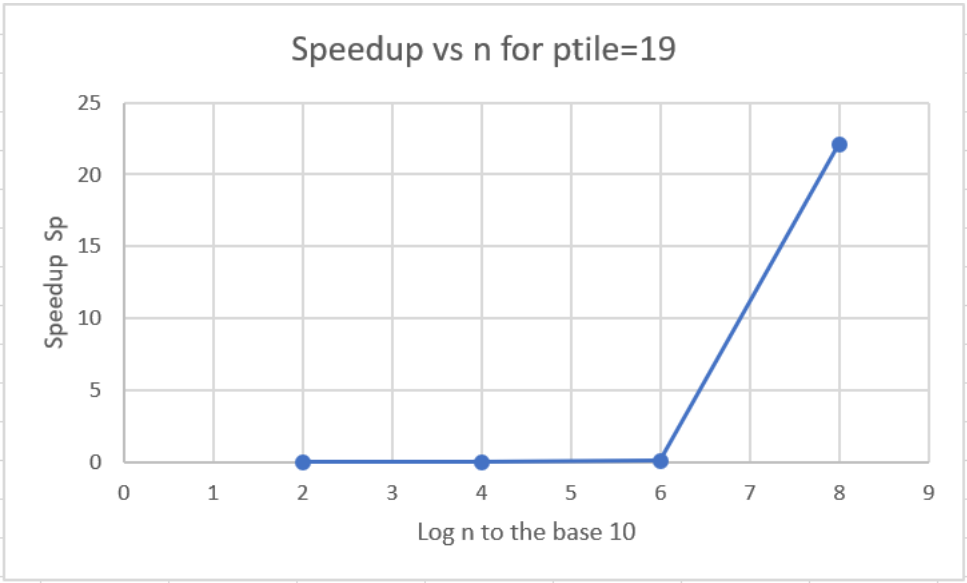
We can see here that on a general case the time taken decreases as ptile increases. And ptile = 19 has taken least amount of time of 0.0453 seconds. Whereas ptile=1 takes maximum amount of time of 0.1407seconds.

Problem 6. (20 points) Repeat the experiments with p=64 for n=$10^2, 10^4, 10^6$ and 10^8.

a. Plot the speedup observed w.r.t. p=1 versus n.

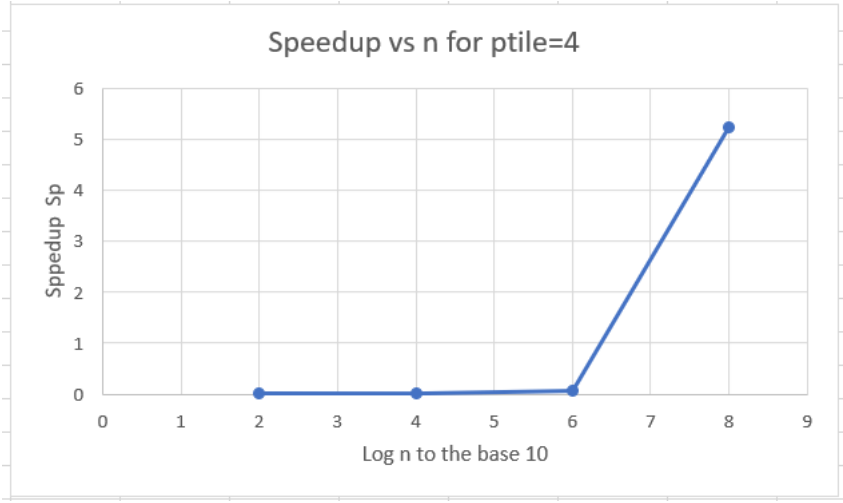
b. Plot the relative error versus n to illustrate the accuracy of the algorithm as a function of n.

Solution. (a) By keeping the ptile value = 19 for which I got the minimum total time, the graph for speedup vs n looks as follows:

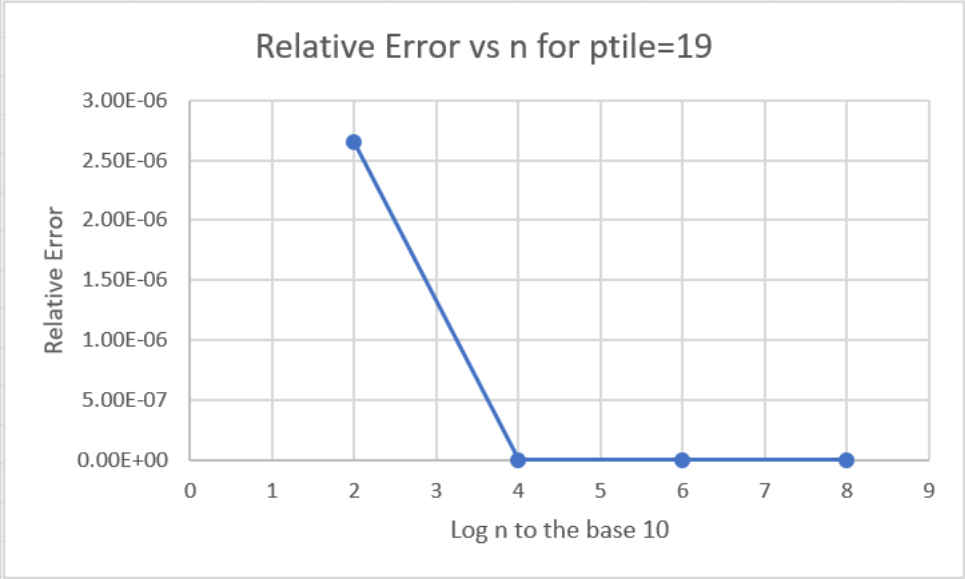


We see that the speedup increases as n increases. It has a minimum value of 0.01298 for n=100 and maximum value of 22.099 for n=10^8

Similarly for ptile=4 we have:



(b) And the Relative error vs n looks as follows:



The relative error decreases as n increases. It is maximum with the value 2.65E-06 at n=100 and minimum at n = 10^8 with the value 7.07E-16. This graph holds for ptile = 4 as well.