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ECE 254

Laboratory 3

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|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N | B | P | C | Average Time (ms) - Processes | Average Time (ms) - Threads | Standard Deviation (ms) - Processes | Standard Deviation (ms) - Threads |
| 100 | 4 | 1 | 1 | 0.485272 | 0.359254 | 0.071053403 | 0.11417776 |
| 100 | 4 | 1 | 2 | 0.469316 | 0.296296 | 0.038420205 | 0.03074183 |
| 100 | 4 | 1 | 3 | 0.504856 | 0.317794 | 0.168967498 | 0.03250852 |
| 100 | 4 | 2 | 1 | 0.485126 | 0.249406 | 0.048230801 | 0.03081385 |
| 100 | 4 | 3 | 1 | 0.536556 | 0.28796 | 0.052840655 | 0.0855923 |
| 100 | 4 | 2 | 2 | 0.479688 | 0.29296 | 0.040167034 | 0.07422047 |
| 100 | 4 | 3 | 3 | 0.581552 | 0.270394 | 0.034656302 | 0.11448563 |
| 100 | 8 | 1 | 1 | 0.482972 | 0.319314 | 0.067576588 | 0.08237851 |
| 100 | 8 | 1 | 2 | 0.470094 | 0.323972 | 0.039035588 | 0.06855992 |
| 100 | 8 | 1 | 3 | 0.496812 | 0.339896 | 0.047661941 | 0.0634619 |
| 100 | 8 | 2 | 1 | 0.488002 | 0.29674 | 0.047628206 | 0.06797532 |
| 100 | 8 | 3 | 1 | 0.53491 | 0.301712 | 0.052394522 | 0.06892954 |
| 100 | 8 | 2 | 2 | 0.485034 | 0.281174 | 0.04157101 | 0.06323578 |
| 100 | 8 | 3 | 3 | 0.57975 | 0.30411 | 0.033365124 | 0.29364384 |
| 398 | 8 | 1 | 1 | 0.699776 | 0.527722 | 0.075305762 | 0.06096547 |
| 398 | 8 | 1 | 2 | 0.800726 | 0.548536 | 0.046497472 | 0.07577261 |
| 398 | 8 | 1 | 3 | 0.78047 | 0.660728 | 0.04344446 | 0.0635981 |
| 398 | 8 | 2 | 1 | 0.825552 | 0.476838 | 0.05074386 | 0.08895064 |
| 398 | 8 | 3 | 1 | 0.851408 | 0.58288 | 0.049324249 | 0.06584702 |
| 398 | 8 | 2 | 2 | 0.664884 | 0.435864 | 0.035085019 | 0.07366088 |
| 398 | 8 | 3 | 3 | 0.81521 | 0.418988 | 0.048460436 | 0.17350999 |

Table 1: Average Execution Time and Standard Deviation of Processes and Threads

Average Time and Standard Deviation

Average times were used to make more accurate conclusions. This is because if a single output of the program was used for comparison, there could be a multitude of factors that result in erroneous answers. Running the program 500 times with the same input and taking the average results in a much more accurate representation of how the processes or threads are working. Averaging removes any outlining erroneous values that could be caused by externalities outside of our control and provide more accurate data. Standard deviation is calculated to show how consistent our data is. This is to show if any erroneous results are present and if so to adjust our analysis accordingly.

Figure 1: Average Execution Time of Processes

Figure 2: Standard Deviation of Processes

Figure 3: Average Execution Time of Threads

Figure 4: Standard Deviation of Threads

From Figures 1-4, it can be seen that processes are almost always slower in terms of average execution time although they have a lower standard deviation.

Advantages and Disadvantages of Threads and Processes

Affect of Number of Items Produced

Figure 5: Average Execution Time Changing Number of Items Produced for Processes

Figure 6: Average Execution Time Changing Number of Items Produced for Threads

Affect of Buffer Size

Figure 7: Average Execution Time While Changing Buffer Size for Processes

Figure 8: Average Execution Time While Changing Buffer Size for Threads

Affect of Number of Producers

Figure 9: Average Execution Time While Changing Number of Producers for Processes

Figure 10: Average Execution Time While Changing Number of Producers for Threads

Affect of Number of Consumers

Figure 11: Average Execution Time While Changing Number of Consumers for Processes

Figure 12: Average Execution Time While Changing Number of Consumers for Threads