TEB1113/TFB2023: ALGORITHM & DATA STRUCTURE

Report on Device Performance (HW1)

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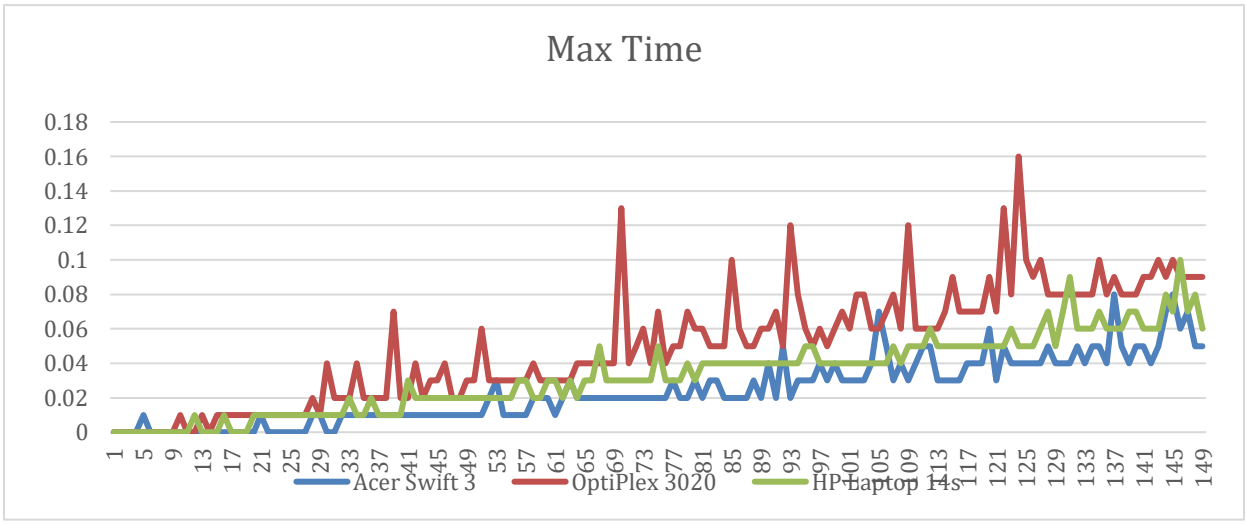
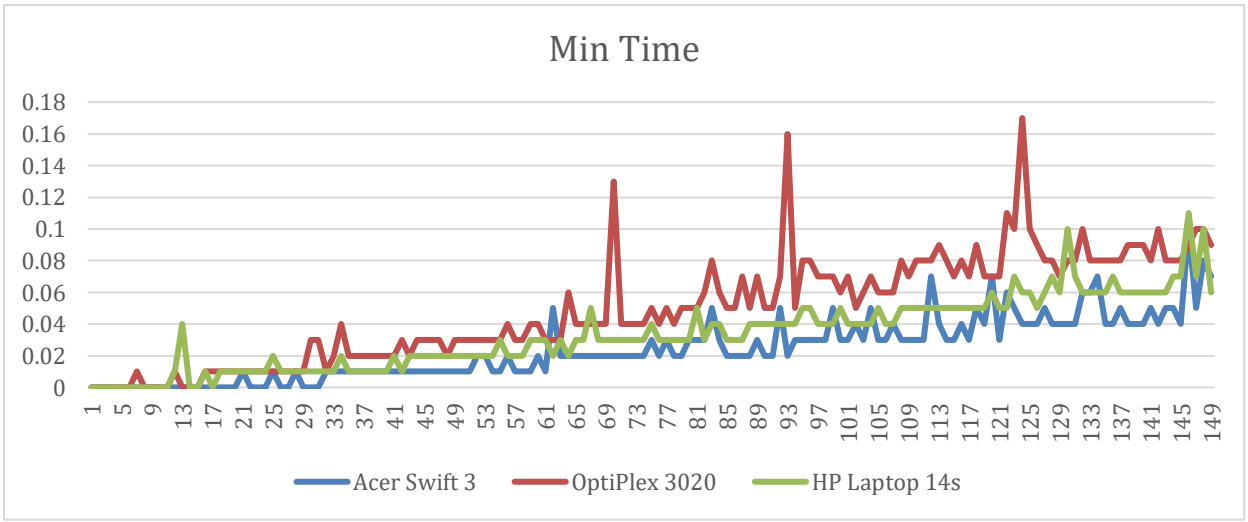
INTRODUCTION

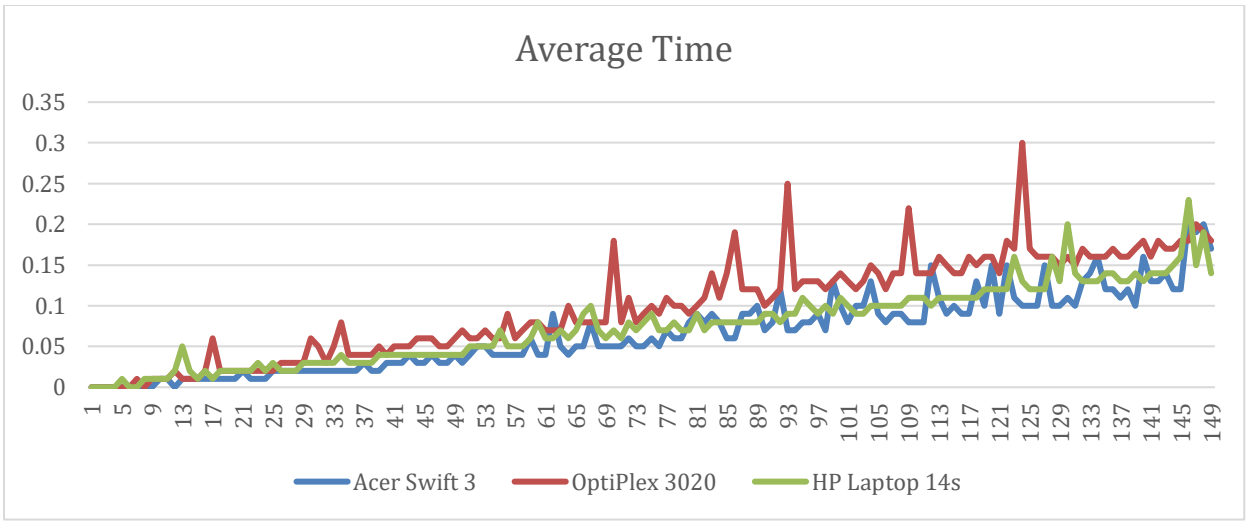
The objective of this report is to analyse the difference in performance between 3 different devices when attempting to run a drone flocking program. These tests were performed with a vary number of drones and different computer hardware to capture the time of the device performing the 5 functions. These 5 functions include maximum, minimum, average, print and bubble sort. The 3 devices that will be in use are Acer Swift 3, OptiPlex 3020 and HP Laptop 14s. Further specifications regarding the devices will be in a table below.

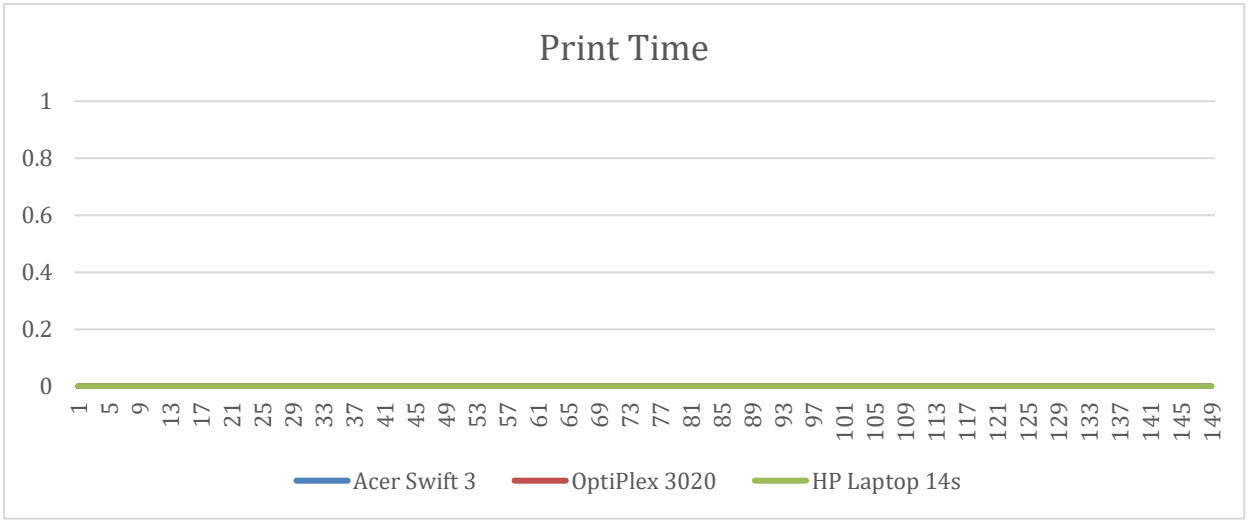
Name	Operating System	CPU	GPU	RAM	ROM
Acer Swift 3	Windows 11	i5-1240P	Integrated Graphics	8GB	512GB SSD
OptiPlex 3020	Windows 10	i5-4590	GTX 1060 6GB	16GB	1TB SSD
HP Laptop 14s	Windows 11	Ryzen 5	Integrated Graphics	8GB	512GB SSD

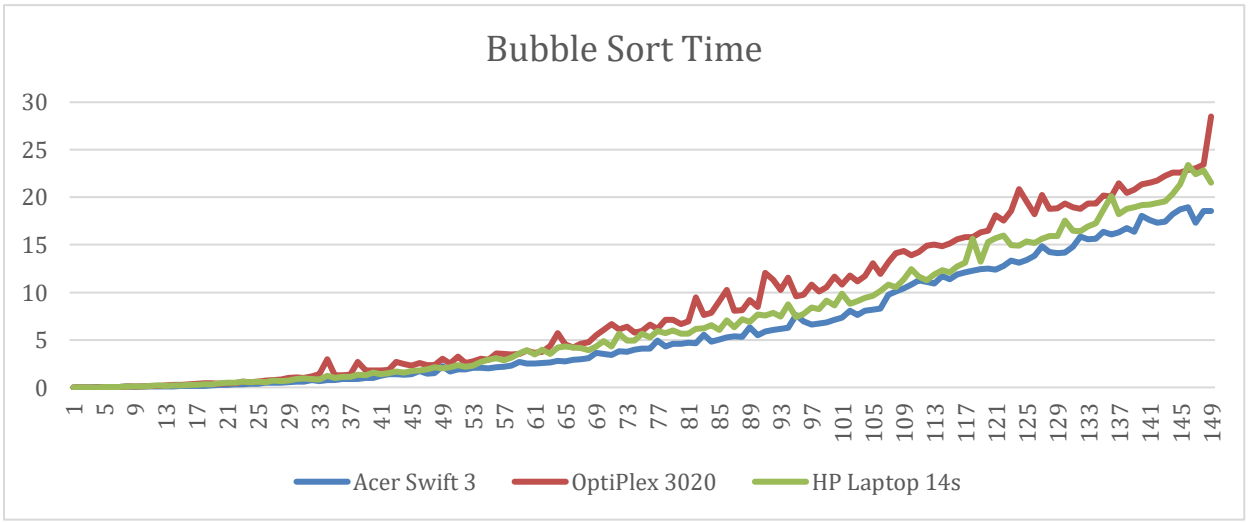
GRAPHS






Average Time
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97 101 105 109 113 117 121 125 129 133 137 141 145 149
Acer Swift 3
OptiPlex 3020
HP Laptop 14s


Print Time
1
0.8
0.6
0.4
0.2
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97 101 105 109 113 117 121 125 129 133 137 141 145 149
Acer Swift 3
OptiPlex 3020
HP Laptop 14s


Bubble Sort Time
30
25
20
15
10
5
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97 101 105 109 113 117 121 125 129 133 137 141 145 149
Acer Swift 3
OptiPlex 3020
HP Laptop 14s

ANALYSIS

Acer Swift 3

In comparison to the OptiPlex 3020, the Acer Swift 3 shows similar performance trends when processing drone datasets range from 100 to 14,900. Both devices handle smaller datasets efficiently, but as the drone count increases, their execution times, particularly for Bubble Sort, grow significantly. The Bubble Sort algorithm poses a computational challenge for larger datasets, with the Acer Swift 3 peaking at 26.8 seconds and the OptiPlex 3020 at 28.5 seconds for 14,900 drones. Other metrics like Max Time, Min Time, and Average Time show more gradual increases, while Print Time remains negligible on both devices. Overall, both devices can handle small workloads significantly well but face limitations when facing larger workloads, especially in sorting tasks.

OptiPlex 3020

When conducting the analysis for the Optiplex 3020 and running the dataset it was given which was a number of drones ranging from 100 to 14900, there are a number of points to point out. Initially, most time values are zero for lower drone counts which indicates negligible processing time. However, when it comes to the Bubble sort algorithm, it has a gradual increase along with the number of drones and it peaks at 28.5 seconds for 14900 drones. The other time metrics such as MaxTime, MinTime and AverageTime do have changes but are subtle and not as gradual as for BubbleSortTime. PrintTime on the other hand, shows that it is consistently zero, meaning it is a negligible impact. This concludes that there is a higher computational demand for Bubble sort when it comes to larger datasets, meaning that more efficient sorting algorithms are to be considered for more efficient and optimized results.

HP Laptop 14s

In the Max Time results, the HP Laptop 14s shows a steady increase in execution time as the number of drones increases. While initially maintaining lower values, the execution time gradually rises with larger datasets, indicating that it becomes progressively slower when handling more drones. For Min Time, the HP Laptop 14s displays consistent performance, with only a slight upward trend as the drone count grows. This suggests that the device can efficiently handle smaller datasets but may face increasing challenges as the workload expands. The Average Time results demonstrate that the HP Laptop 14s maintains stable performance for moderate datasets but sees a noticeable increase in execution time as the number of drones increases. This trend shows that while the device is capable of handling moderate workloads, larger datasets cause the average execution time to grow significantly. In the Print Time results, the HP Laptop 14s shows relatively stable performance across most of the dataset sizes. The print function execution times remain steady but exhibit a slight increase as the number of drones rises, which is expected given the additional data being processed. For the Bubble Sort Time, the HP Laptop 14s demonstrates a steady increase in execution time as the dataset size grows. The sorting operation becomes more time-consuming with larger datasets, showing that the device can handle sorting efficiently for smaller datasets but struggles with higher numbers of drones. In conclusion, the HP Laptop 14s performs efficiently with smaller datasets, handling tasks like max, min, average, print, and sorting functions effectively.

However, as the number of drones increases, the execution times for all tasks begin to rise, indicating that the device encounters limitations when processing larger workloads. Despite this, its overall performance remains consistent and reliable within moderate dataset sizes.

CONCLUSION

In summary, the analysis displays a clear relationship between a device's hardware and the performance of the program. We have gathered that the Acer Swift 3 demonstrates the best performance when running the program. Through our analysis, the Acer Swift 3 can handle a higher number of drones with a lower response time. In comparison, the HP Laptop 14s and the Dell OptiPlex 3020 show weaker performance, with the differences becoming more noticeable as the number of drones increases. While the HP Laptop 14s performs moderately well, the performance gap between it and the Acer Swift 3 is not easily noticeable without recorded statistics. However, the Dell OptiPlex 3020 lags significantly in comparison to both. Hence, the conclusion is that better hardware, as seen with the Acer Swift 3, improves program performance more effectively than attempting to optimize the program alone. While investing in better hardware will enhance performance, it may prove more cost-effective in the long run to optimize the program as much as possible before resorting to hardware upgrades.