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| --- | --- | --- |
| **Selection Sort** | | |
| **List Size** | **Comparisons** | **Time (seconds)** |
| **1,000 (observed)** | 499500 | 0.07 |
| **2,000 (observed)** | 1999000 | 0.30 |
| **4,000 (observed)** | 7998000 | 1.5 |
| **8,000 (observed)** | 31996000 | 6.10 |
| **16,000 (observed)** | 49995000 | 8.9 |
| **32,000 (observed)** | 127992000 | 21 |
| **100,000 (estimated)** | 4095872000 | 306 |
| **500,000 (estimated)** | 102396800000 | 7650 |
| **1,000,000 (estimated)** | 409587200000 | 30600 |
| **10,000,000 (estimated)** | 4095872000000 | 3060000 |

|  |  |  |
| --- | --- | --- |
| **Insertion Sort** | | |
| **List Size** | **Comparisons** | **Time (seconds)** |
| **1,000 (observed** | 251745 | 0.10 |
| **2,000 (observed)** | 991223 | 0.39 |
| **4,000 (observed)** | 4011739 | 1.89 |
| **8,000 (observed)** | 16221126 | 6.66 |
| **16,000 (observed)** | 63896432 | 25.84 |
| **32,000 (observed)** | 257507119 | 39.93 |
| **100,000 (estimated)** | 100000000 | 128 |
| **500,000 (estimated)** | 400000000 | 512 |
| **1,000,000 (estimated)** | 1600000000 | 2048 |
| **10,000,000 (estimated)** | 6400000000 | 8192 |

1. Which sort do you think is better? Why?
   1. Insertion sort. Insertion sort best case is O(n) complexity, whereas selection sort best case is O(N^2). Insertion sort sorts the final location of an object, but selection sort switches comparatively. Insertion sort is also advantageous because it creates a sorted list, which is more optimal than the unsorted in selection sort.
2. Which sort is better when sorting a list that is already sorted (or mostly sorted)? Why?
   1. If the list is already sorted, insertion sort is best because it completes sorting in linear time, and does less swaps over time compared to the selection sort that comparatively sorts the list.
3. You probably found that insertion sort had about half as many comparisons as selection sort. Why? Why are the times for insertion sort not half what they are for selection sort? (For part of the answer, think about what insertion sort has to do more of compared to selection sort.)
   1. Insertion sort does O(N^2) swaps, but the selection\_sort does N swaps. The swap is in the outer loop in select sort but in the inner loop in insertion sort. In all cases of selection sort, a selected value is compared with all other unsorted items, but insertion sort can be in best case linear. Insertion sort has to move backwards through the list to find the location where the item should be stored for each item.