|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Input Size | Insertion Sort 0(n2) | Merge Sort  O(nlogn) | Selection Sort  0(n2) | Quick Sort  O(nlogn) |
| 2,000 | 0.124s | 0.044s | 0.052s | 0.024s |
| 4,000 | 0.352s | 0.076s | 0.160s | 0.012s |
| 10,000 | 1.744s | 0.116s | 0.628s | 0.024s |
| 20,000 | 6.736s | 0.204s | 2.236s | 0.052s |
| 50,000 | 42.004s | 0.456s | 13.640s | 0.112s |
| 100,000 | 168.252s | 0.828s | 53.964s | 0.204s |
| 1,000,000 | Est. 16,825.2s | 9.988s | Est. 5,396.4s | 1.468s |
| 10,000,000 | Est. 1,682,520s | 1m 2.756s | Est. 539,640s | 21.508s |

**CSCI 271: Program 4 Tables**

Table : Shows the growth rates for all 4 sorting algorithms. Please note: insertion sort and selection sort were not tested at the input sizes above 1 million.

**CSCI 271: Program 4 Report**

**Analysis**: After analyzing the Insertion Sort algorithm, I came to the conclusion that the input size is in a x:x2 relationship with the execution time. For example (and the table reflects this relationship), if you increase the input size by 2.5, then the execution time could be estimated to be 6.25 times larger than the previous. This relationship will not produce an exact answer because there are other constants that are not accounted for, but it can be used to give a good estimation for what the execution time would be at a very large input size. The table above gives a good example of the relationship. Another thing to note is that the estimation becomes more accurate as the input size gets larger because at larger input sizes, the constants become less and less relevant to the execution time.

**Estimate the execution time for Insertion Sort algorithm @ input size of 1,000,000:**According to my data collected, the execution time for the Insertion Sort algorithm at input size 100,000 is 168.252 seconds. Using the analysis explained above, multiplying the input size by 10 to get 1,000,000 will mean we multiply the execution time by 100 – giving us **an estimated execution time of 16,825.2 seconds** (280.42 minutes or a little over 4.5 hours).

**Estimate the execution time for Insertion Sort algorithm @ input size of 10,000,000:**  
According to my data collected, the execution time for the Insertion Sort algorithm at input size 100,000 is 168.252 seconds. Using the analysis explained above, multiplying the input size by 100 to get 10,000,000 will mean we multiply the execution time by 10,000 – giving us an **estimated execution time of 1,682,520 seconds** (28,042 minutes, or a little over 467 hours, or about 19.5 days).