**Assignment 1 Discussion Questions**

**3.** In order to determine the average runtime for the program, we record the average times taken for 20 different data arrays from 1000 to 20,000. For ISort an average of 5 time values per data array was recorded. For ISSort an average of 3 time values per data array was recorded.

Once the times are recorded, we can divide each time by the number of data and average each processing time per data to get an average runtime per data.

For ISort the average runtime was 22936.00059 ns. For ISSort the average runtime was 47431.23379 ns, or roughly two times ISort.

**4.** see below.

**5.** Since the ‘structuring’ pass involves making a pass through all values of N, the structured insertion sort takes roughly twice as long as ISort. It’s interesting to note however that for both cases there was a significant reduction in processing time at 16,000 – 17,000 data. This is because the processor dynamically allocates more power to the program.

**Data Tables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Isort data** | **Isort avg time (ns)** | **Isort time/data (ns)** | **ISSort data** | **ISSort avg time (ns)** | **ISSort time/data (ns)** |
| 1000 | 42392985 | 42392.985 | 1000 | 72505141 | 72505.141 |
| 2000 | 57533585 | 28766.7925 | 2000 | 157877709 | 78938.8545 |
| 3000 | 63317275 | 21105.75833 | 3000 | 169068014 | 56356.00467 |
| 4000 | 90520724 | 22630.181 | 4000 | 199130234 | 49782.5585 |
| 5000 | 105196274 | 21039.2548 | 5000 | 244139063 | 48827.8126 |
| 6000 | 112755975 | 18792.6625 | 6000 | 336481105 | 56080.18417 |
| 7000 | 146392323 | 20913.189 | 7000 | 263439117 | 37634.15957 |
| 8000 | 170046289 | 21255.78613 | 8000 | 332077734 | 41509.71675 |
| 9000 | 199870353 | 22207.817 | 9000 | 354165746 | 39351.74956 |
| 10000 | 210805910 | 21080.591 | 10000 | 426305376 | 42630.5376 |
| 11000 | 219804987 | 19982.27155 | 11000 | 432471880 | 39315.62545 |
| 12000 | 248096175 | 20674.68125 | 12000 | 442784916 | 36898.743 |
| 13000 | 293417555 | 22570.58115 | 13000 | 595980215 | 45844.63192 |
| 14000 | 317427773 | 22673.41236 | 14000 | 698424419 | 49887.4585 |
| 15000 | 381242979 | 25416.1986 | 15000 | 763136366 | 50875.75773 |
| 16000 | 459089614 | 28693.10088 | 16000 | 682116652 | 42632.29075 |
| 17000 | 289577101 | 17033.94712 | 17000 | 607304670 | 35723.80412 |
| 18000 | 330086809 | 18338.15606 | 18000 | 723008235 | 40167.12417 |
| 19000 | 385068272 | 20266.75116 | 19000 | 769827322 | 40517.22747 |
| 20000 | 457717890 | 22885.8945 | 20000 | 862905875 | 43145.29375 |
|  | **average:** | 22936.00059 |  | **average:** | 47431.23379 |

**Data Graphs**



