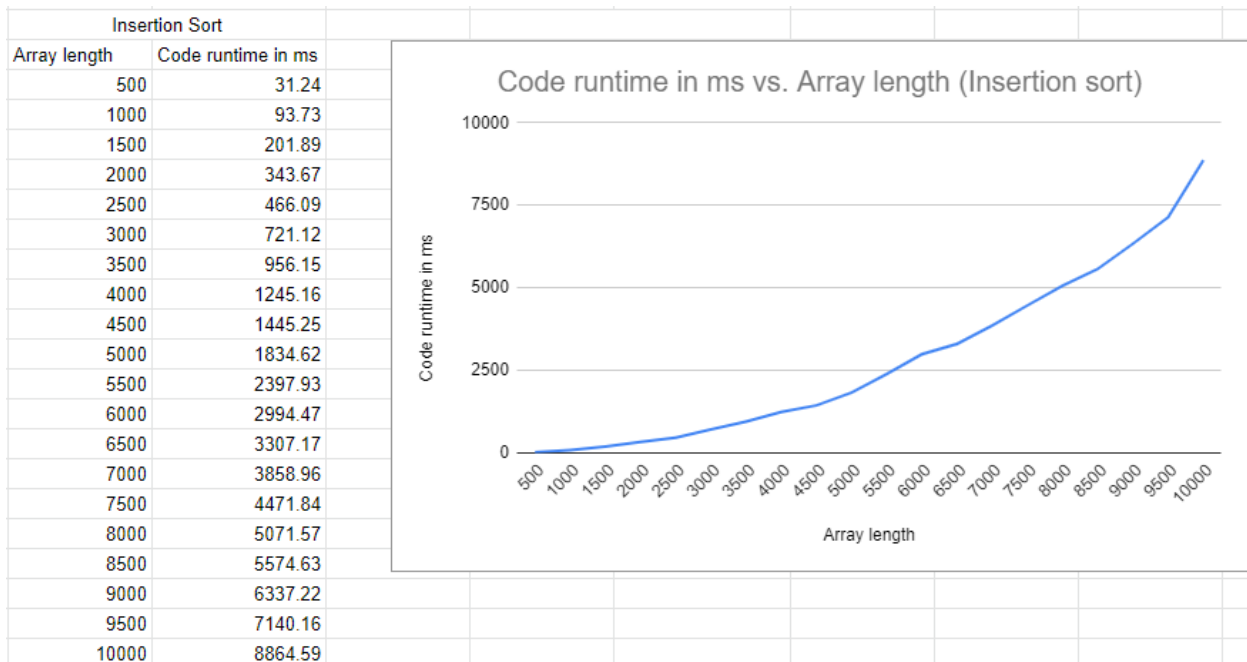# Laboratory practice No. 2: Algorithm's Complexity

**Sofía Saldarriaga Sánchez**
Universidad Eafit
Medellín, Colombia
ssaldarris@eafit.edu.co

**Full name of second student**
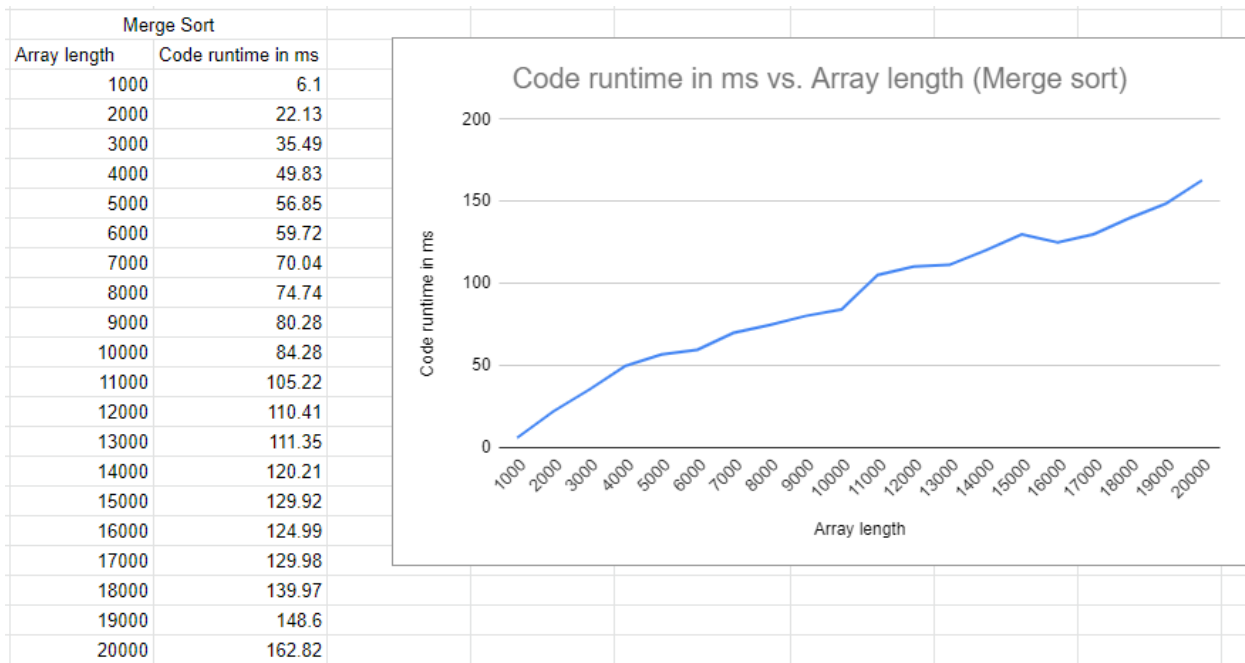Universidad Eafit
Medellín, Colombia
Correointegrante2@eafit.edu.co

**3)** Practice for final project defense presentation

| Insertion Sort | |
|---|---|
| Array length | Code runtime in ms |
| 500 | 31.24 |
| 1000 | 93.73 |
| 1500 | 201.89 |
| 2000 | 343.67 |
| 2500 | 466.09 |
| 3000 | 721.12 |
| 3500 | 956.15 |
| 4000 | 1245.16 |
| 4500 | 1445.25 |
| 5000 | 1834.62 |
| 5500 | 2397.93 |
| 6000 | 2994.47 |
| 6500 | 3307.17 |
| 7000 | 3858.96 |
| 7500 | 4471.84 |
| 8000 | 5071.57 |
| 8500 | 5574.63 |
| 9000 | 6337.22 |
| 9500 | 7140.16 |
| 10000 | 8864.59 |



Code runtime in ms vs. Array length (Insertion sort)

**PhD. Mauricio Toro Bermúdez**
Professor | School of Engineering | Informatics and Systems
Email: mtorobe@eafit.edu.co | Office: Building 19 – 627
Phone: (+57) (4) 261 95 00 Ext. 9473

| Merge Sort | |
|---|---|
| Array length | Code runtime in ms |
| 1000 | 6.1 |
| 2000 | 22.13 |
| 3000 | 35.49 |
| 4000 | 49.83 |
| 5000 | 56.85 |
| 6000 | 59.72 |
| 7000 | 70.04 |
| 8000 | 74.74 |
| 9000 | 80.28 |
| 10000 | 84.28 |
| 11000 | 105.22 |
| 12000 | 110.41 |
| 13000 | 111.35 |
| 14000 | 120.21 |
| 15000 | 129.92 |
| 16000 | 124.99 |
| 17000 | 129.98 |
| 18000 | 139.97 |
| 19000 | 148.6 |
| 20000 | 162.82 |



Code runtime in ms vs. Array length (Merge sort)

3.3 Merge sort is more efficient than insertion sort. If we take a look at the graphs above, we can see that merge sort can sort arrays much faster. For example, it takes insertion sort almost 9 seconds to sort 10,000 numbers, while merge sort can sort 20,000 numbers in only 162.8 milliseconds.

3.4 It wouldn't be ideal to use insertion sort to sort millions of numbers in real time. It would take too much time to render the images, which would make the video game unplayable.
3.5 Insertion sort can be faster than merge sort for big if the most of the numbers in the array are already in order. In this case insertion sort takes less time to run because it has to make less comparisons.

3.6 In our implementation we use two loops to cycle the array twice in order to find out if there is more than one span. The span is calculated by subtracting the position in the array of a number from that same number's last position. If two spans are found, the Math.max function is used to compare both spans in order to see which one is bigger. Finally, the method returns the biggest span.

3.7

| Exercise | Level | T(N) Notation | Big O Notation |
|---|---|---|---|
| CountEvens | 2 | T(n)= n + c | O(n) |
| BigDiff | 2 | T(b)= b + c | O(n) |
| CenteredAverage | 2 | T(d)= d + c | O(d) |
| Sum13 | 2 | T(a)= a + c | O(a) |
| Has22 | 2 | T(f)= f + c | O(f) |

**PhD. Mauricio Toro Bermúdez**
Professor | School of Engineering | Informatics and Systems
Email: mtorobe@eafit.edu.co | Office: Building 19 – 627
Phone: (+57) (4) 261 95 00 Ext. 9473

UNIVERSIDAD EAFIT®
Acreditación Institucional
Renovación 2018 - 2026
Resolución MEN 2158 de 2018

**Inspira Crea Transforma**

Vigilada Mineducación    www.eafit.edu.co

| MaxSpan | 3 | T(g)= g^2 + c | O(g^2) |
|---|---|---|---|
| Fix34 | 3 | T(h)= h^2 + c | O(h^2) |
| Fix45 | 3 | T(h)= h + c | O(h) |
| CanBalance | 3 | T(i)= i^2 + c | O(i^2) |
| LinearIn | 3 | T(j)= k + c | O(k) |

3.8

| Variable | Explanation |
|---|---|
| n | The length of an array where the algorithm will count even numbers. |
| b | The length of an array in which the algorithm will search for the maximum and minimum value |
| d | The average between the values of an array excluding the maximum and minimum values |
| a | The sum of an array |
| f | An array in which the algorithm will check if ther are two consecutive 2 |
| g | The largest span in ana array between two positins with the same number values. |
| h | Temporal variable that stores a position of the array |
| i | An array for which you can splt it in two parts so that both sum the same |
| k | An array for which each value is also located on another given array |

4) Practice for midterms

4.1  b

4.2  b

4.3  b

4.4  b

4.5

4.5.2   d

4.5.2 Yes, unless the number is outside the range of type int, which is 2,147,483,648 for both positive and negative ways.

4.6   It would take more or less 100.000 seconds to process 10000 data.

4.7  d

**PhD. Mauricio Toro Bermúdez**
Professor | School of Engineering | Informatics and Systems
Email: mtorobe@eafit.edu.co  | Office: Building 19 – 627
Phone: (+57) (4) 261 95 00 Ext. 9473

UNIVERSIDAD **EAFIT** ® | **Acreditación Institucional** Renovación 2018 - 2026 Resolución MEN 2158 de 2018

4.8  a

**PhD. Mauricio Toro Bermúdez**
Professor | School of Engineering | Informatics and Systems
Email: mtorobe@eafit.edu.co  | Office: Building 19 – 627
Phone: (+57) (4) 261 95 00 Ext. 9473

**Inspira Crea Transforma**

Vigilada Mineducación    **www.eafit.edu.co**