

# Implementación y Evaluación del Algoritmo Quicksort.

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# 1 Introducción

En este informe, se presenta un estudio sobre el rendimiento del algoritmo de ordenamiento Quicksort aplicado a diferentes arreglos de datos. Se describirá el procedimiento de implementación del algoritmo, la selección del pivote y se presentarán los resultados en forma de gráficos.

# 2 Desarrollo

El algoritmo de Quicksort es un algoritmo de ordenamiento que se basa en la técnica de dividir y conquistar. Se selecciona un elemento como pivote y se dividen los datos en dos subconjuntos, uno con elementos menores que el pivote y otro con elementos mayores. Luego, se repite el proceso en los subconjuntos de manera recursiva hasta que todos los elementos estén ordenados.

En nuestra implementación, el pivote se selecciona como el primer elemento del arreglo, es decir,  $pivote = arr[0]$ . Se dividen los datos en tres grupos: elementos menores que el pivote, elementos iguales al pivote y elementos mayores que el pivote. Esto se hace con las siguientes líneas de código:

```
pivote = arr[0]
left = [x for x in arr if x < pivote]
middle = [x for x in arr if x == pivote]
right = [x for x in arr if x > pivote]
```

Luego, se llama al algoritmo Quicksort de manera recursiva en los subconjuntos izquierdo y derecho, y se concatenan los resultados.

```
return quicksort(left) + middle + quicksort(right)
```

Se generaron 100 arreglos aleatorios de diferentes longitudes y se midió el tiempo que tardó el algoritmo en ordenar cada uno de ellos. Los tres arreglos que menos tiempo tardaron se muestran a continuación:

## 1. Arreglo más rápido 1:

[97052, 40656, 68283, 9714, 82591, 20916, 90219, 99979, 46618, 30895, 95282, 71682, 91881, 43790, 57970, 72188, 46751, 2795, 8057, 67925, 29704, 18064, 48164, 80615, 85834, 32504, 63745, 93116, 90449, 19720, 8326, 72831, 43512, 76743, 93499, 51893, 96711, 69513, 17315, 39867, 43328, 16658, 14215, 29119, 38539, 69621, 40079, 65958, 51953, 12794, 4321, 37968, 53205, 19148, 65698, 10145, 52686, 4846, 10453, 72599, 27243, 10634, 97816, 6312, 15249, 38318, 23340, 5519, 22279, 95860, 6799, 19196, 76290, 5300, 33424, 46576, 63257, 80029, 77945, 68530, 66009, 96628, 4084, 9538, 82797, 60346, 40643, 62592, 96484, 19201, 55064, 86530, 11339, 54916, 43392, 40332, 72345, 61275, 2209, 20007, 84342, 52166, 37537, 24379, 79255, 71473, 17626, 76130, 56868, 6137, 93929, 82066, 26882, 66981, 16570, 8886, 68474, 3181, 26453, 76608,

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2. Arreglo más rápido 2: [50654, 85001, 53780, 30836, 60204, 67283, 53220, 4468, 90394, 47992, 53197, 12210, 49155, 38070, 33863, 52901, 4465, 40677, 27456, 2685, 79026, 70429, 6903, 94800, 88554, 96766, 83214, 6928, 7961, 87548, 54984, 48560, 67493, 20283, 4849, 77985, 72726, 34270, 67755, 56044, 15512, 58425, 67612, 73009, 96578, 93135, 63921, 47075, 6135, 29332, 18102, 38891, 42578, 56993, 21185, 61753, 47487, 48121, 63511, 99765, 55657, 7283, 66435, 66166, 35456, 64832, 22933, 93899, 310, 7055, 88524, 62389, 88854, 92744, 26033, 63210, 29960, 60440, 91451, 86524, 5148, 49715, 38756, 51671, 64786, 40614, 17368, 21685, 47811, 502, 89068, 11788, 32105, 50967, 58857, 39686, 57703, 78686, 77904, 91686, 64785, 88030, 11127, 5568, 41189, 13242, 25501, 13170, 42886, 81033, 56527, 30326, 93847, 65680, 29525, 39102, 48994, 69368, 87490, 57076, 30571, 89492, 84322, 57296, 81498, 52296, 87978, 98986, 21622, 38748,

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3. Arreglo más rápido 3: [83631, 28834, 53538, 85573, 58604, 8381, 14368, 58255, 43715, 70658, 64782, 46480, 51643, 50769, 94114, 1456, 35226, 83336, 25557, 13777, 23449, 1162, 82866, 61783, 17735, 45311, 66012, 63693, 93866, 15633, 341, 57687, 39800, 25083, 59499, 76607, 5120, 55428, 77866, 10150, 90154, 29811, 66977, 44136, 87009, 84379, 41599, 39859, 72429, 46097, 39840, 7999, 58506, 36642, 96955, 85169, 29839, 27369, 27505, 28204, 94052, 55963, 13760, 96956, 4608, 66894, 27176, 51896, 55019, 21437, 20002, 45137, 57385, 26289, 4122, 45709, 58023, 43172, 11998, 93140, 35590, 59200, 50138, 9530, 5607, 44016, 28455, 82498, 87252, 7836, 30547, 18019, 96219, 58170, 41315, 91194, 5234, 12945, 88053, 46188, 62914, 97656, 10778, 43165, 71180, 20362, 60793, 26628, 47092, 66835, 4483, 22559, 20127, 84784, 56079, 8251, 29390, 46681, 23311, 56507, 45054, 25573, 81928, 76489, 61655, 13422, 78452, 3902, 97798, 44478, 67139, 71879, 75965, 11585, 31934, 1173, 89696, 97385, 48342, 36918, 88923, 61025, 96448, 62875, 92354, 32448, 6681, 81868, 9516, 2059, 68932, 57118, 54645, 5734, 72369, 23242, 60789, 76791, 67040, 20383, 94135, 66840, 3370, 78661, 47815, 50443, 13620, 39945, 18965, 69545, 63363, 75249, 75755, 38510, 96910, 72121, 58252, 45676, 86208, 74728, 47325, 1807, 36319, 77699, 27063, 86889, 1879, 18250, 57525, 69956, 7584, 32310, 27164, 72512, 52132, 91941, 97023, 41429, 31173, 96045, 87307, 89747, 99905, 67505, 56410, 77120, 24825, 72955, 63703, 82898, 22808, 90406, 91669, 55690, 38753, 96117, 17701, 74217, 61007, 25599, 35189, 84415, 61117, 5697, 2946, 13229, 3559, 90484, 7166, 56319, 76487, 78146, 20986, 89963, 63853, 11352, 41513, 6286, 47511, 75830, 19795, 45846, 6232, 96513, 58742, 43550, 11738, 1174, 68572, 28871, 10452, 76982, 76412, 73937, 78193, 40685, 67218, 54603, 48096, 40423,

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### 3 Gráfica

A continuación, se muestra la gráfica que representa los tiempos de ordenamiento de los 100 arreglos aleatorios. Los puntos resaltados indican los tres arreglos que menos tiempo tardaron en ordenarse.

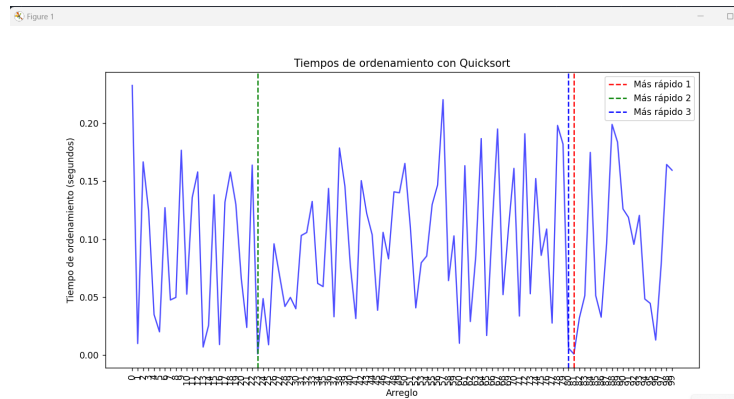


Figure 1: Tiempos de ordenamiento con Quicksort

## 4 Conclusiones

En este estudio, se observó que el algoritmo Quicksort es eficiente en la mayoría de los casos, pero su rendimiento puede variar según los datos de entrada. La elección del pivote y la partición de los datos son aspectos clave en el rendimiento del algoritmo. Los resultados muestran los tres arreglos que menos tiempo tardaron en ordenarse, lo que sugiere que sus características particulares los hacen más adecuados para este algoritmo.

## 5 Referencias

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