

1. Introdução

No mundo da computação é essencial entregar um código limpo, bem estruturado e com um processo de compilação em um menor e armazenamento possível (mas é praticamente impossível obter todos esses resultados ao mesmo tempo). Portanto, para obter um código eficiente e otimizado (afim de alcançar bons resultados citados anteriormente, deve-se analisar os algoritmos específicos de cada área e comparar cada um, sendo definido por busca, ordenação e outros.

É importante salientar que para se ter um resultado plausível, em relação ao processo de compilação e armazenamento, analisa-se a quantidade de termos presentes no algoritmo, pois, um algoritmo de tamanho 5 seria sempre menor que 1000. Outro fato seria a junção da quantidade de termos com a complexidade, notação Big O notation, do algoritmo, seja para um caso médio ou bom.

Nesse caso, aprofundando mais o assunto, tem-se os algoritmos de ordenação: Quick Sort, Merge Sort, Selection Sort, Bubble Sort e Insertion Sort, sendo os 2 primeiros usando recursividade e os 3 últimos usando apenas vetores.

2. Explicação dos algoritmos de Ordenação

- **Bubble Sort:** O algoritmo menos eficiente. Nesse, há um percorrido do vetor até achar o maior elemento e colocá-lo nas primeiras posições de uma lista.

Exemplo: Veja a imagem junto com o código

Por meio de um for, colocamos o maior termo no final da lista

5 4 3 2 1 4 5 3 2 1 4 3 5 2 1 4 3 2 5 1 4 3 2 1 5

Assim, se repete...

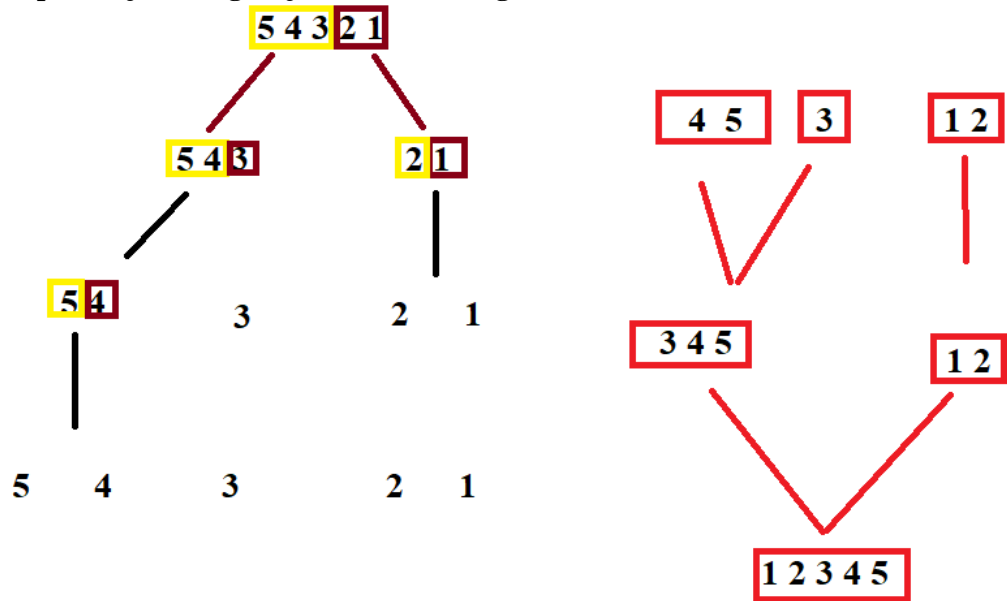
3 4 2 1 5 3 2 4 1 5 3 2 1 4 5

2 3 1 4 5 2 1 3 4 5

1 2 3 4 5

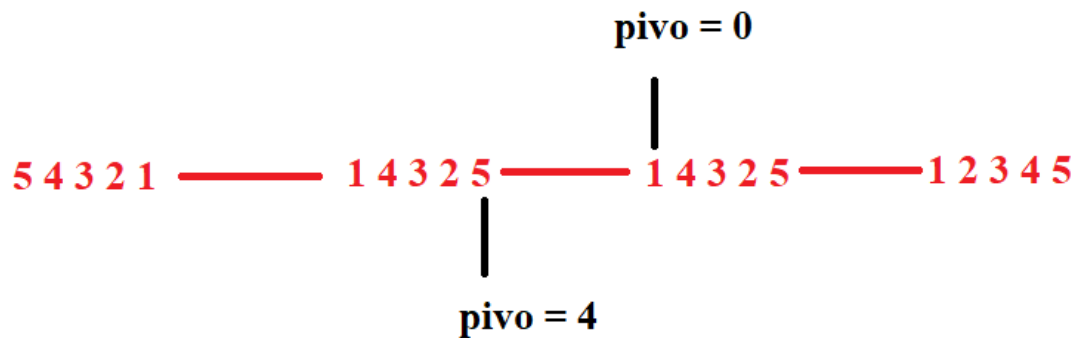
- **Merge Sort:** A ideia básica deste algoritmo é dividir (dividir dados em sequências pequenas), conquistar (classificar duas metades usando o merge sort) e combinar (juntar dados pequenos já ordenados, quando separados).

Exemplo: Veja a imagem junto com o código



- Quick Sort: Neste será comparado dois “ponteiros (dividindo em esquerda e direita)” e sempre o compararemos ao índice de repartição, ordenando assim , termos em maior e menos pela índice achado. Observação: Tem várias formas de obter o índice de repartição. Então, deve-se prestar atenção sobre qual forma foi escolhida pelo programador.

Exemplo: Veja a imagem junto com o código.



3. Após isso, é possível observar a notação em Big(o) dos algoritmos de ordenação:

Bubble Sort – $C(n) = O(n^2)$ - Pior, Melhor e Médio caso

Insertion Sort – Melhor Caso $C(n) = O(n)$ e Pior Caso = $C(n) = O(n^2)$

Selection Sort - $C(n) = O(n^2)$ - Pior, Melhor e Médio caso

Quick Sort - $C(n) = O(n \log n)$ – Melhor Caso e Pior Caso = $C(n) = O(n^2)$

Merge Sort - $C(n) = O(n \log n)$ – Pior, Melhor e Médio Caso.

Por meio disso, percebe-se que os algoritmos Quick e Merge Sort são os melhores para ordenação.

4. Abordamos algumas formas de fazer ordenação de vetores e fizemos um gráfico sobre a rapidez de cada para uma determinada quantidade de vetores. Observação: Estes foram preenchidos com um número inteiro aleatório.

TRABALHANDO COM VETOR DE TAMANHO 6

Normal Vector: [8376, 1026, 5663, 9988, 8418, 5676, 4915, 6090, 3877, 255]

-----Sorting Vectors-----

Bubble_Sort: [255, 1026, 3877, 4915, 5663, 5676, 6090, 8376, 8418, 9988]

Tempo: 2.5800000003073364e-05

Insertion_Sort: [255, 1026, 3877, 4915, 5663, 5676, 6090, 8376, 8418, 9988]

Tempo: 1.2399999945955642e-05

Selection_Sort: [255, 1026, 3877, 4915, 5663, 5676, 6090, 8376, 8418, 9988]

Tempo: 1.3699999954042141e-05

Merge_Sort:: [255, 1026, 3877, 4915, 5663, 5676, 6090, 8376, 8418, 9988]

Tempo: 2.949999998236308e-05

Quick_Sort: [255, 1026, 3877, 4915, 5663, 5676, 6090, 8376, 8418, 9988]

Tempo: 2.0700000050055678e-05

TRABALHANDO COM VETOR DE TAMANHO 1000

Normal Vector = [4475, 9963, 8628, 3111, 5624, 4249, 5136, 1729, 1345, 5817, 654, 6042, 4161, 458, 1480, 9728, 5696, 6205, 8047, 8728, 1329, 3515, 9941, 3736, 4930, 5649, 3598, 7737, 8106, 4498, 4372, 1194, 1482, 4094, 2307, 9899, 4127, 4169, 3200, 49, 4904, 6622, 1070, 3048, 7205, 6106, 1324, 374, 6222, 2938, 3652, 4820, 5404, 8772, 3513, 1483, 4229, 6819, 3617, 9011, 5772, 9175, 3832, 7887, 8564, 9384, 6353, 3, 1199, 3327, 3807, 4571, 8470, 5732, 5933, 2074, 6046, 9494, 3797, 9036, 6495, 9895, 6027, 829, 6525, 9009, 3345, 4149, 290, 7042, 7685, 7045, 5240, 3488, 9505, 8102, 9595, 9067, 2260, 4192, 7012, 8276, 9275, 2347, 1073, 2549, 9676, 1182, 2905, 756, 9922, 6800, 6495, 4798, 7692, 2381, 1901, 5688, 9751, 8575, 232, 9205, 8233, 767, 9541, 7050, 519, 5190, 5792, 8705, 2200, 3431, 1660, 3623, 6163, 2196, 3831, 813, 7531, 959, 2140, 9169, 5483, 205, 4234, 614, 4864, 8445, 2142, 367, 6192, 8472, 2840, 8118, 8305, 2916, 4820, 947, 36, 4852, 9441, 9657, 1135, 9688, 1812, 800, 9199, 9312, 6991, 5820, 7583, 7967, 4528, 7052, 840, 9667, 357, 9022, 1712, 4510, 828, 6346, 3383, 6287, 6568, 8890, 8151, 6011, 8165, 6397, 2550, 1672, 8363, 8296, 9607, 8957, 5613, 116, 2616, 3487, 2525, 6909, 4845, 7083, 96, 1751, 5905, 4924, 9229, 7957, 6045, 9333, 2763, 7992, 3164, 4497, 1880, 6644, 5701, 3560, 7368, 297, 7494, 9838, 5397, 5783, 8968, 7837, 3086, 9656, 3554, 7287, 7552, 6596, 2574, 1139, 9667, 7832, 5387, 9143, 3501, 8147, 4446, 9039, 6921, 6501, 44, 8103, 5639, 5361, 2194, 8768, 8340, 4871, 318, 1649, 8533, 4929, 6397, 8832, 7162, 9541, 2602, 8285, 1606, 8946, 6850, 4665, 3506, 3475, 693, 2635, 76, 9230, 7283, 657, 1464, 1834, 2709, 3274, 5137, 3953, 889, 3665, 4387, 7413, 3546, 3422, 2408, 2572, 9637, 3619, 9772, 4887, 1521, 1157, 4362, 6431, 4227, 1089, 7051, 5142, 1420, 398, 6361, 4259, 3748, 1606, 1409, 3406, 5720, 922, 4765, 4367, 7985, 7286, 6854, 8073, 5260, 7451, 862, 8162, 8516, 8336, 597, 4440, 6204, 6771, 6183, 4852, 7891, 3379, 494, 9599, 5122, 8656, 2548, 4491, 232, 221, 1670, 5084, 7091, 6968, 799, 3041, 926, 3361, 6322, 7379, 1775, 4368, 3450, 5419, 8501, 7614, 2587, 9154, 2131, 8063, 1157, 1734, 6232, 8256, 7135, 9232, 4147, 9162, 2472, 1439, 7960, 1367, 2525, 3054, 68, 2461, 6855, 1943, 2056, 7963, 8207, 7521, 8839, 9917, 8498, 6993, 3935, 1086, 9030, 3375, 8201, 4887, 8975, 9705, 3328, 8138, 3168, 1531, 7012, 2458, 4300, 9814, 6523, 9714, 8538, 5130, 1923, 5839, 4215, 1362, 209, 5938, 4846, 6347, 5337, 8944, 5214, 7889, 1327, 5964, 933, 3271, 1153, 5317, 5877, 1626, 9679, 9541, 9593, 2901, 2269, 8780, 7234, 1947, 5411, 9859, 6707, 3435, 8787, 7478, 9766, 8501, 6292, 4405, 6155, 8277, 1133, 6470, 4426, 9195, 5208, 8726, 269, 8490, 5221, 3883, 5352, 7870, 3635, 6553, 3052, 4273, 6763, 3931, 6560, 2540, 2470, 2414, 1740, 6601, 7674, 8097, 9017, 9871, 9529, 1474, 4492, 1963, 1603, 8356, 7811, 6074, 1548, 7088, 2889, 2510, 7661, 3232, 40, 5788, 2750, 9114, 5154, 9450, 9452, 2180, 850, 7159, 7703, 2036, 3559, 8583, 8994, 1444, 1280, 7158, 1852, 6198, 8521, 7663, 8168, 1903, 3805, 2574, 3274, 402, 1672, 4260, 6569, 3693, 2984, 9848, 3066, 9339, 8278, 7870, 2299, 5165, 2519, 9500, 3492, 1010, 8168, 9367, 8087, 783, 8795, 7438, 7270, 4902, 7769, 2112, 5101, 4217, 387, 7211, 9330, 396, 7438, 5013, 7547, 3648, 5510, 2264, 920, 5220, 7485, 9287, 7568, 8832, 1590, 2042, 7547, 2613, 9270, 8538, 6354, 1478, 6926, 2794, 9350, 2671, 113, 686, 545, 9533, 5294, 8566, 7602, 7604, 7687, 2797, 1813, 8385, 2875, 6415, 4110, 5011, 7312, 2445, 9552, 9301, 6586, 8015, 5887, 4695, 8225, 9723, 3553, 7025, 8371, 2221, 2011, 5574, 262, 711, 9842, 8099, 9204, 6348, 6339, 3594, 5104, 896, 9965, 1857, 8272, 9039, 6998, 734, 4671, 8178, 9611, 6374, 2988, 2127, 922, 3108, 6431, 9406, 2096, 2985, 7188, 6446, 7248, 7447, 6332, 6459, 3691, 5051, 3027, 331, 3556, 8552, 2104, 763, 9078, 5114, 8063, 9842, 4748, 6718, 2464, 7537, 7775, 3802, 3410, 8703, 2876, 1889, 1122, 7238, 5257, 3615, 4186, 3097, 1364, 1483, 9909, 1183, 6644, 6976, 1187, 2376,

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-----Sorting Vectors-----

Bubble_Sort: [3, 6, 10, 25, 36, 40, 44, 49, 68, 76, 96, 97, 113, 116, 132, 178, 189, 195, 195, 200, 205, 209, 221, 232, 232, 244, 262, 267, 269, 270, 290, 297, 302, 307, 318, 331, 345, 357, 362, 367, 374, 387, 396, 398, 402, 402, 458, 469, 494, 519, 545, 597, 614, 631, 652, 653, 654, 657, 681, 686, 693, 703, 711, 734, 756, 763, 767, 783, 789, 799, 800, 813, 824, 828, 829, 839, 840, 841, 850, 860, 862, 889, 896, 920, 922, 922, 926, 933, 936, 937, 946, 947, 959, 964, 967, 1010, 1070, 1073, 1086, 1089, 1122, 1133, 1135, 1139, 1153, 1157, 1157, 1164, 1172, 1182, 1183, 1187, 1190, 1194, 1199, 1208, 1221, 1246, 1256, 1264, 1280, 1317, 1324, 1327, 1329, 1345, 1362, 1364, 1367, 1409, 1420, 1439, 1442, 1444, 1464, 1472, 1473, 1474, 1478, 1480, 1482, 1483, 1483, 1489, 1492, 1493, 1493, 1521, 1531, 1548, 1554, 1590, 1603, 1606, 1606, 1607, 1626, 1649, 1655, 1660, 1670, 1672, 1672, 1712, 1723, 1729, 1734, 1734, 1740, 1751, 1775, 1802, 1812, 1813, 1831, 1834, 1845, 1852, 1857, 1880, 1889, 1901, 1901, 1903, 1923, 1943, 1947, 1963, 1971, 1973, 1987, 1994, 2011, 2036, 2040, 2042, 2056, 2063, 2073, 2074, 2096, 2103, 2104, 2105, 2112, 2127, 2131, 2134, 2140, 2142, 2180, 2191, 2194, 2196, 2200, 2221, 2260, 2264, 2264, 2266, 2269, 2278, 2286, 2299, 2307, 2310, 2335, 2347, 2368, 2376, 2381, 2392, 2408, 2414, 2445, 2457, 2458, 2461, 2464, 2470, 2472, 2493, 2510, 2512, 2519, 2525, 2525, 2540, 2548, 2548, 2549, 2550, 2572, 2574, 2574, 2587, 2602, 2613, 2616, 2635, 2647, 2649, 2659, 2666, 2671, 2682, 2709, 2734, 2750, 2763, 2787, 2794, 2794, 2797, 2816, 2821, 2825, 2835, 2840, 2875, 2876, 2889, 2901, 2905, 2916, 2938, 2945, 2953, 2963, 2984, 2985, 2988, 3019, 3027, 3041, 3048, 3052, 3054, 3066, 3074, 3086, 3090, 3097, 3108, 3111, 3117, 3158, 3164, 3168, 3169, 3177, 3177, 3200, 3217, 3232, 3233, 3241, 3252, 3271, 3274, 3274, 3309, 3309, 3327, 3328, 3345, 3358, 3361, 3375, 3379, 3383, 3406, 3410, 3422, 3431, 3435, 3436, 3440, 3450, 3454, 3475, 3487, 3488, 3492, 3498, 3501, 3502, 3506, 3513, 3515, 3519, 3546, 3553, 3554, 3556, 3559, 3560, 3565, 3594, 3598, 3613, 3615, 3617, 3619, 3623, 3635,

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Bubble_Sort: Tempo: 31,9783572999999

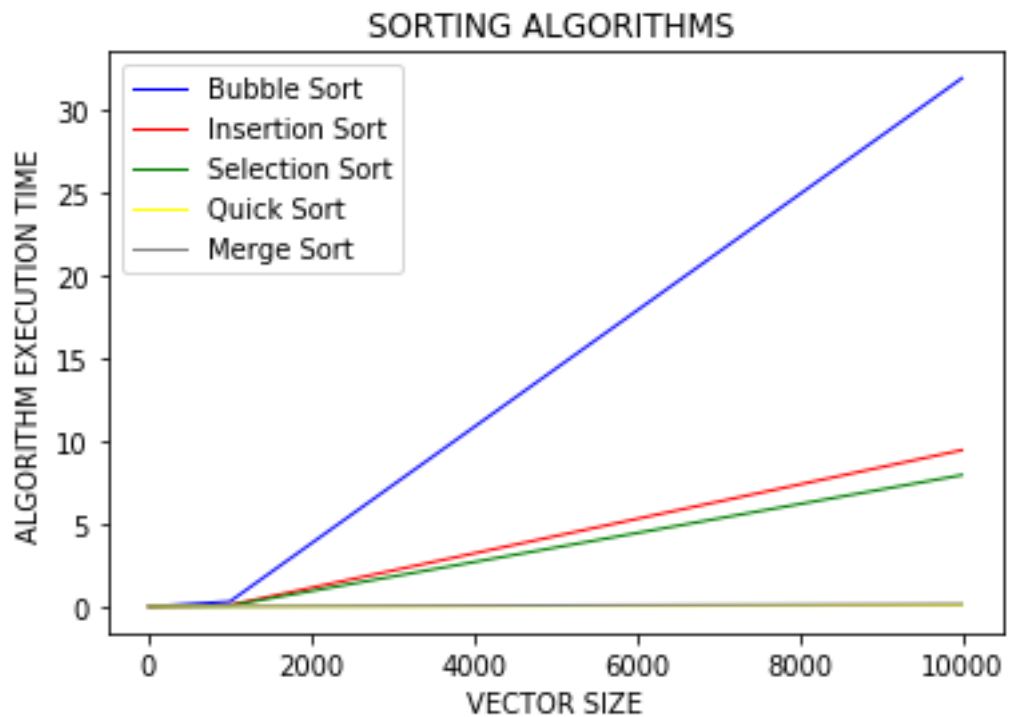
Insertion_Sort: Tempo: 9,4652789

Selection_Sort: Tempo: 7,9527646

Merge_Sort: Tempo: 0,1520442

Quick_Sort: Tempo: 0,0755325

5. Depois disso, faremos um gráfico em python para mostrar a comparação do tempo de execução do algoritmo para 3 tamanhos.



Percebe-se que é muito difícil de identificar o algoritmo Merge Sort e Quick Sort pois estão muito próximos.

