

# Relatório Trabalho Prático de Laboratório (Ordenação e Busca)

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#### Introdução

Este relatório consiste na análise entre os algoritmos de ordenação BubbleSort e SelectionSort. Serão apresentadas as conclusões sobre as comparações, trocas e tempo de execução entre os dois algoritmos sobre cada um dos respectivos arquivos fornecidos para os testes.

**BubbleSort:** Ordenação por trocas. Examina sistematicamente elementos adjacentes de um conjunto e troca suas posições se for necessário. Compara cada elemento da lista com o elemento seguinte. O processo se repete até que toda a lista esteja ordenada. É um dos algoritmos de ordenação mais fáceis de entender e implementar do zero.

**SelectionSort:** Consiste em selecionar o menor item e colocar na primeira posição, selecionar o segundo menor item e colocar na segunda posição, segue estes passos até que reste um único elemento. Não é um algoritmo estável. Neste algoritmo de ordenação é escolhido um número a partir do primeiro, este número escolhido é comparado com os números a partir da sua direita, quando encontrado um número menor, o número escolhido ocupa a posição do menor número encontrado.

### Metodologia:

#### Observações sobre os algoritmos desenvolvidos:

Ambos os algoritmos (BubbleSort e SelectionSort) desenvolvidos em Golang e C++ realizam de forma equivalente (seguindo as características disponíveis de cada linguagem) a lógica da contagem e execução das comparações, trocas, leitura e escrita dos dados nas estruturas dinâmicas e nos arquivos.

**Golang:** Os algoritmos de ordenação desenvolvidos em Go utilizaram estruturas dinâmicas do tipo Slice para os tipos específicos de cada um dos 3 arquivos disponibilizados para os testes. Para ambos os algoritmos de ordenação (BubbleSort e SelectionSort) foi desenvolvido a função swap a parte.

C++: Os algoritmos de ordenação desenvolvidos em C++ utilizaram a estrutura dinâmica vector para os tipos específicos para os arquivos nomes.txt e pessoas.txt pois, ao utilizar estrutura estática para os dados, erros na execução do algoritmo ocorreram por conta de um possível estouro de pilha (mesmo utilizando comandos que expandissem a capacidade do programa na pilha). Para o arquivo número.txt o uso da estrutura estática não resultou em erros. A função swap não foi desenvolvida a parte e sim implementada pela biblioteca <algorithm>.

# **Tabelas Comparativas**

As tabelas comparativas contendo dados de tempo de execução, número de trocas e número de comparações sobre os algoritmos Bubblesort e Golang implementados nas duas linguagens de programação, foram preenchidas a partir dos testes solicitados no enunciado do trabalho.

Um script bash foi desenvolvido para executar cada um dos dois algoritmos de ordenação para os 3 arquivos nas duas linguagens, aumentando os registros de 1000 em 1000 até seu valor máximo de 100.000. A partir de cada execução os tempos, trocas e comparações de cada volume de registros foram extraídos de um arquivo de saída .txt para as tabelas comparativas. Esse processo foi feito para os 3 arquivos nos dois algoritmos de ordenação nas duas linguagens mencionadas. A partir dos valores coletados as medias de cada implementação foram calculadas e gráficos comparativos foram desenvolvidos.

Os algoritmos foram desenvolvidos e implementados utilizando um HP laptop 15-ef1xxx com AMD Ryzen 3 3250U 2.60GHz, 8,00 GB de RAM e SSD NVMe v1.4 WDC PC SN530 sdbpnpz-256g-1006 no Windows 10 Home (x64) Build 19044.2965 (21H2).

**Obs:** O notebook ficou todo o tempo conectado a energia para melhor desempenho dos testes.

# **Bubblesort: Golang x C++**

### **Nomes:**

					NOMES			
					BubbleSort			
			Golang		Bubblesoft		C++	
REGISTROS	TESTES	Tempo de Execucao (seg)	Contador de Comparacoes	Contador Swap	Tompo d	e Execucao (seg)	Contador de Comparacoes	Contador Swap
1000	1	0,0085	499.500	253.846	0.0200	e Execucao (seg)	499.500	253.846
2000	2	0,0225	1.999.000	1.028.822	0,0200		1.999.000	1.028.822
3000	3	0.0460	4.498.500	2.256.906	0,0570		4.498.500	2.256.906
4000	4	0,0868	7.998.000	3.995.792	0,1060		7.998.000	3.995.792
5000	5	0,1365	12.497.500	6.275.184	0,3670		12.497.500	6.275.184
6000	6	0,2172	17.997.000	9.006.540	0,2660		17.997.000	9.006.540
7000	7	0,2946	24.496.500	12.384.544	0,3220		24.496.500	12.384.544
8000	8	0,3793	31,996,000	16.171.985	0,4540		31.996.000	16.171.985
9000	9	0.4808	40.495.500	20.314.797	0,5660		40.495.500	20.314.797
10000	10	0,5999	49.995.000	25.077.258	0,8610		49.995.000	25.077.258
11000	11	0.7036	60.494.500	30.257.446	1,3310		60.494.500	30,257,446
12000	12	0,8827	71.994.000	35.914.753	1,3290		71.994.000	35,914,753
13000	13	1,0480	84.493.500	42.330.342	1,5010		84.493.500	42.330.342
14000	14	1,1920	97.993.000	49.097.426	1,5490		97.993.000	49.097.426
15000	15	1,3804	112.492.500	56.488.578	1,4860		112.492.500	56.488.578
16000	16	1,5810	127.992.000	64.187.932	2,0480		127.992.000	64.187.932
17000	17	1,8522	144.491.500	72.391.735	2,1810		144.491.500	72.391.735
18000	18	2,0913	161.991.000	81.059.410	2,3780		161.991.000	81.059.410
19000	19	2,2572	180.490.500	90.339.620	2,5800		180.490.500	90.339.620
20000	20	2,5615	199.990.000	99.909.888	2,7630		199.990.000	99.909.888
21000	21	2,7449	220.489.500	109.881.158	3,1910		220.489.500	109.881.158
22000	22	3,0994	241.989.000	120.363.918	3,4870		241.989.000	120.363.918
23000	23	3,3892	264.488.500	131.877.934	3,9550		264.488.500	131.877.934
24000	24	3,6274	287.988.000	142.985.354	4,2470		287.988.000	142.985.354
25000	25	4,0075	312.487.500	155.021.122	4,8110		312.487.500	155.021.122
26000	26	4,8130	337.987.000	167.970.175	5,2410		337.987.000	167.970.175
27000	27	5,3381	364.486.500	181.398.280	5,7780		364.486.500	181.398.280
28000	28	5,7225	391.986.000	195.323.027	6,2900		391.986.000	195.323.027
29000	29	6,1466	420.485.500	208.755.358	6,4110		420.485.500	208.755.358
30000	30	5,8832	449.985.000	223.769.055	6,5500		449.985.000	223.769.055
31000	31	6,3369	480.484.500	239.079.148	6,4770		480.484.500	239.079.148
32000	32	6,7871	511.984.000	255.135.475	7,1640		511.984.000	255.135.475
33000	33	7,2313	544.483.500	271.562.858	7,2720		544.483.500	271.562.858
34000	34	7,7030	577.983.000	288.403.165	7,7310		577.983.000	288.403.165
35000	35	8,0920	612.482.500	305.951.205	8,0860		612.482.500	305.951.205
36000	36	8,6048	647.982.000	323.655.348	9,2680		647.982.000	323.655.348
37000	37	9,1584	684.481.500	341.700.135	9,4280		684.481.500	341.700.135
38000	38	10,7949	721.981.000	360.439.673	9,6030		721.981.000	360.439.673
39000	39	11,2751	760.480.500	379.789.203	11,0850		760.480.500	379.789.203
40000	40	12,1087	799.980.000	399.173.522	11,0050		799.980.000	399.173.522
41000	41	11,6538	840.479.500	420.353.003	11,1880		840.479.500	420.353.003
42000	42	12,0388	881.979.000	440.741.036	12,2750		881.979.000	440.741.036
43000 44000	43	13,2790	924.478.500	461.687.842	12,6950		924.478.500	461.687.842
44000 45000	44	14,1411 14,7879	967.978.000 1.012.477.500	483.588.523 505.636.790	13,9110 13,6280		967.978.000 1.012.477.500	483.588.523 505.636.790
46000	46	15,6044	1.012.477.500	528.118.548	13,6280		1.012.477.500	528.118.548
47000	46	15,8956	1.104.476.500	550.918.717	15,4800		1.104.476.500	550.918.717
48000	47	15,5280	1.151.976.000	574.499.676	16,2320		1.151.976.000	574.499.676
48000	48	16,2640	1.200.475.500	598.637.959	17,0210		1.200.475.500	598.637.959
50000	50	16,2640	1.200.475.500	623.370.020	17,0210		1.249.975.000	623.370.020
51000	50	17,5910	1.300.474.500	648.459.100	17,7880		1.300.474.500	648.459.100
52000	51	18,4382	1.351.974.000	674.806.770	18,9450		1.351.974.000	674.806.770
53000	52	19,0951	1.404.473.500	701.660.121	19,2040		1.404.473.500	701.660.121
54000	54	19,7965	1.457.973.000	728.306.433	23,3270		1.457.973.000	728.306.433
54000	34	20,7076	1.512.472.500	754.976.500	22,5240		1.512.472.500	754.976.500

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56000	56	21,2761	1.567.972.000	783.136.284	22,3590	1.567.972.000	783.136.284
57000	57	22,2693	1.624.471.500	810.794.377	25,0930	1.624.471.500	810.794.377
58000	58	23,1368	1.681.971.000	840.117.497	26,7050	1.681.971.000	840.117.497
59000	59	24,0952	1.740.470.500	869.177.256	26,9400	1.740.470.500	869.177.256
60000	60	24,9233	1.799.970.000	899.085.866	27,6550	1.799.970.000	899.085.866
61000	61	25,6591	1.860.469.500	930.022.134	33,5890	1.860.469.500	930.022.134
62000	62	26,5699	1.921.969.000	959.626.537	30,1970	1.921.969.000	959.626.537
63000	63	27,5184	1.984.468.500	991.279.152	48,2480	1.984.468.500	991.279.152
64000	64	28,5770	2.047.968.000	1.023.477.163	32,0470	2.047.968.000	1.023.477.163
65000	65	29,2204	2.112.467.500	1.056.571.096	34,3410	2.112.467.500	1.056.571.096
66000	66	30,3653	2.177.967.000	1.089.471.164	33,3760	2.177.967.000	1.089.471.164
67000	67	31,3161	2.244.466.500	1.121.553.716	35,3760	2.244.466.500	1.121.553.716
68000	68	32,0570	2.311.966.000	1.155.700.331	35,9530	2.311.966.000	1.155.700.331
69000	69	33,4189	2.380.465.500	1.190.468.665	36,5800	2.380.465.500	1.190.468.665
70000	70	37,1263	2.449.965.000	1.225.348.064	38,2930	2.449.965.000	1.225.348.064
71000	71	37,8683	2.520.464.500	1.260.415.125	38,5790	2.520.464.500	1.260.415.125
72000	72	36,4413	2.591.964.000	1.296.693.155	40,0440	2.591.964.000	1.296.693.155
73000	73	37,6306	2.664.463.500	1.332.913.177	41,5510	2.664.463.500	1.332.913.177
74000	74	39,1442	2.737.963.000	1.370.326.067	42,5100	2.737.963.000	1.370.326.067
75000	75	39,4890	2.812.462.500	1.407.082.881	43,2800	2.812.462.500	1.407.082.881
76000	76	40,7351	2.887.962.000	1.445.537.458	46,6350	2.887.962.000	1.445.537.458
77000	77	41,7352	2.964.461.500	1.484.201.273	45,8210	2.964.461.500	1.484.201.273
78000	78	42,8307	3.041.961.000	1.523.592.749	47,9170	3.041.961.000	1.523.592.749
79000	79	44,0122	3.120.460.500	1.563.251.318	48,0710	3.120.460.500	1.563.251.318
80000	80	44,8899	3.199.960.000	1.603.500.999	52,1970	3.199.960.000	1.603.500.999
81000	81	46,0012	3.280.459.500	1.643.015.755	55,5650	3.280.459.500	1.643.015.755
82000	82	47,5259	3.361.959.000	1.683.560.669	55,9640	3.361.959.000	1.683.560.669
83000	83	49,0056	3.444.458.500	1.724.086.955	55,0280	3.444.458.500	1.724.086.955
84000	84	49,5439	3.527.958.000	1.766.495.962	56,6560	3.527.958.000	1.766.495.962
85000	85	51,2742	3.612.457.500	1.808.968.183	57,9730	3.612.457.500	1.808.968.183
86000	86	52,3558	3.697.957.000	1.851.649.934	62,8440	3.697.957.000	1.851.649.934
87000	87	53,5408	3.784.456.500	1.895.685.175	64,4140	3.784.456.500	1.895.685.175
88000	88	55,1432	3.871.956.000	1.940.252.160	64,4070	3.871.956.000	1.940.252.160
89000	89	56,8492	3.960.455.500	1.984.111.214	64,7910	3.960.455.500	1.984.111.214
90000	90	57,9447	4.049.955.000	2.028.467.318	63,4700	4.049.955.000	2.028.467.318
91000	91	58,8046	4.140.454.500	2.074.166.465	74,9440	4.140.454.500	2.074.166.465
92000	92	60,6963	4.231.954.000	2.120.622.050	71,9840	4.231.954.000	2.120.622.050
93000	93	61,7749	4.324.453.500	2.167.605.643	69,3770	4.324.453.500	2.167.605.643
94000	94	63,3929	4.417.953.000	2.214.145.919	72,1270	4.417.953.000	2.214.145.919
95000	95	65,2285	4.512.452.500	2.262.883.737	72,8620	4.512.452.500	2.262.883.737
96000	96	65,9805	4.607.952.000	2.311.953.076	76,1450	4.607.952.000	2.311.953.076
97000	97	68,1025	4.704.451.500	2.360.485.217	74,6980	4.704.451.500	2.360.485.217
98000	98	69,4063	4.801.951.000	2.408.747.315	94,2940	4.801.951.000	2.408.747.315
99000	99	71,0299	4.900.450.500	2.458.939.447	79,9500	4.900.450.500	2.458.939.447
100000	100	77,6531	4.999.950.000	2.508.020.350	80,0690		2.508.020.350
	MÉDIA	23,96	1.691.724.750	846.639.450	27,07	1.691.724.750	846.639.450

Nota-se aqui que Golang e C++ no início dos registros até 55.000 possuem pouca diferença de tempo com Golang predominante. Porém conforme os algoritmos se aproximam dos registros finais Golang apresenta melhores tempos em relação a C++ que tem um aumento considerável nos tempos finais. Assim considerando a média final dos tempos, Golang se sobressai com 3,11 segundos a menos que C++ para Strings.

### Números

					NUMEROS			
					BubbleSort			
			Golang				C++	
REGISTROS	TESTES	Tempo de Execucao (seg)	Contador de Comparacoes	Contador Swap		Tempo de Execucao (seg)	Contador de Comparacoes	Contador Swap
1000	1	0,0017	499.500	249.361		0,0020	499.500	249.361
2000	2	0,0047	1.999.000	991.771		0,0060	1.999.000	991.771
3000	3	0,0112	4.498.500	2.197.013		0,0130	4.498.500	2.197.013
4000	4	0,0189	7.998.000	3.970.151		0,0190	7.998.000	3.970.151
5000	5	0,0297	12.497.500	6.225.156		0,0310	12.497.500	6.225.156
6000	6	0,0456	17.997.000	9.000.595		0,0420	17.997.000	9.000.595
7000		0,0563	24.496.500	12.252.493		0,0650	24.496.500	12.252.493
8000	8	0,0861	31.996.000	16.043.647		0,0850	31.996.000	16.043.647
9000	9	0,1066	40.495.500	20.291.571		0,1090	40.495.500	20.291.571
10000	10	0,1463	49.995.000	24.905.884		0,1380	49.995.000	24.905.884
11000	11	0,1771	60.494.500	30.211.023		0,1710	60.494.500	30.211.023
12000	12	0,1979	71.994.000	35.897.114		0,2130	71.994.000	35.897.114
13000	13	0,2650	84.493.500	42.504.277		0,2530	84.493.500	42.504.277
14000	14	0,3449	97.993.000	49.472.852		0,3110	97.993.000	49.472.852
15000	15	0,3285	112.492.500	56.750.916		0,3280	112.492.500	56.750.916
16000	16	0,4164	127.992.000	64.474.837		0,4080	127.992.000	64.474.837
17000	17	0,4519	144.491.500	72.864.708		0,4690	144.491.500	72.864.708
18000	18	0,5487	161.991.000	81.420.801		0,5080	161.991.000	81.420.801
19000	19	0,5842	180.490.500	90.760.598		0,5650	180.490.500	90.760.598
20000	20	0,7113	199.990.000	100.558.210		0,6660	199.990.000	100.558.210
21000	21	0,7374	220.489.500	110.873.293		0,6990	220.489.500	110.873.293
22000	22	0,7824	241.989.000	121.287.940		0,8830	241.989.000	121.287.940
23000	23	0,9124	264.488.500	132.222.576		0,8390	264.488.500	132.222.576
24000	24	1.0059	287.988.000	144.185.247		0.9440	287.988.000	144.185.247
25000	25	1.2352	312,487,500	156.365.732		1.0590	312.487.500	156.365.732
26000	26	1,2160	337.987.000	168.949.731		1,0630	337.987.000	168.949.731
27000	27	1,2493	364.486.500	182.599.177		1,1580	364.486.500	182.599.177
28000	28	1,3586	391.986.000	196.213.533		1,2870	391.986.000	196.213.533
29000	29	1,4572	420.485.500	210.487.570		1,3880	420.485.500	210.487.570
30000	30	1,5463	449.985.000	224.993.141		1,7380	449.985.000	224.993.141
31000	31	1,7082	480.484.500	240.028.711		1,6020	480.484.500	240.028.711
32000	32	1,7697	511.984.000	256.181.311		1,7630	511.984.000	256.181.311
33000	33	1.9260	544.483.500	272.350.642		1.9440	544.483.500	272.350.642
34000	34	2,1242	577.983.000	289.355.441		1.8820	577.983.000	289.355.441
35000	35	2,2663	612.482.500	306.831.822		2,2290	612.482.500	306.831.822
36000	36	2,3397	647.982.000	324.457.223		2,0590	647.982.000	324.457.223
37000	37	2,5290	684.481.500	342.301.484		2,5090	684.481.500	342.301.484
38000	38	2,7465	721.981.000	361.386.570		2,7930	721.981.000	361.386.570
39000	39	2,9370	760.480.500	380.804.839		2,4510	760.480.500	380.804.839
40000	40	4,2096	799.980.000	400.778.854		2,6360	799.980.000	400.778.854
41000	41	4,6612	840.479.500	420.473.852		2.8020	840.479.500	420.473.852
42000	42	3,4653	881,979,000	441.846.180		3.0000	881.979.000	441,846,180
43000	43	6.1074	924.478.500	463,002,787		3.0000	924.478.500	463.002.787
44000	44	4,1486	967.978.000	484.546.645		3.2880	967.978.000	484.546.645
45000	45	4.1465	1.012.477.500	506.662.744		3.3430	1.012.477.500	506.662.744
46000	46	5.1042	1.057.977.000	529,211,729		3,4930	1.057.977.000	529.211.729
47000	47	4.3686	1.104.476.500	551.813.211		3.6520	1.104.476.500	551.813.211
48000	48	4,6335	1.151.976.000	575.317.752		4.0470	1.151.976.000	575.317.752
49000	49	5,5773	1.200.475.500	599.638.008		4,0710	1.200.475.500	599.638.008
50000	50	5,0883	1.249.975.000	624.289.428		4,1670	1.249.975.000	624.289.428
51000	51	5,1433	1.300.474.500	650.071.734		4,5460	1.300.474.500	650.071.734
31000	21	3,1733	1.300.414.300	030.011.134		7,5700	1.300.414.300	030.011.134

52000         52         5,3069         1,351,974,000         675,675,014         4,5710         1,351,974           53000         53         5,3791         1,404,473,500         701,802,020         4,8020         1,404,473           54000         54         5,6337         1,457,973,000         729,158,168         5,0320         1,457,973           55000         55         6,1268         1,512,472,500         756,306,494         5,0000         1,512,472           56000         56         6,3317         1,567,972,000         783,462,198         5,4870         1,567,972           57000         57         7,6003         1,624,471,500         811,341,861         5,4720         1,624,471	3.500 701.802.020 3.000 729.158.168 .500 756.306.494 2.000 783.462.198 .500 811.341.861 .000 840.534.568
\$4000         \$4         \$5,6337         \$1,457,973,000         729,158,168         \$5,0320         \$1,457,973,000           \$5000         \$5         \$6,1268         \$1,512,472,500         \$756,306,494         \$5,0000         \$1,512,472,500           \$6000         \$6         \$6,3317         \$1,567,972,000         \$783,462,198         \$5,4870         \$1,567,972,500           \$7000         \$7         \$7,6003         \$1,624,471,500         \$11,341,861         \$5,4720         \$1,624,471	8.000     729.158.168       2.500     756.306.494       2.000     783.462.198       3.500     811.341.861       3.000     840.534.568
55000         55         6,1268         1.512.472.500         756.306.494         5,0000         1.512.472           56000         56         6,3317         1.567.972.000         783.462.198         5,4870         1.567.972           57000         57         7,6003         1.624.471.500         811.341.861         5,4720         1.624.471	.500 756.306.494 2.000 783.462.198 1.500 811.341.861 1.000 840.534.568
56000         56         6,3317         1.567.972.000         783.462.198         5,4870         1.567.972           57000         57         7,6003         1.624.471.500         811.341.861         5,4720         1.624.471	2.000 783.462.198 1.500 811.341.861 .000 840.534.568
57000 57 7,6003 1.624.471.500 811.341.861 5,4720 1.624.471	.500 811.341.861 .000 840.534.568
	.000 840.534.568
<u>58000</u> 58 6,9987 <u>1.681.971.000</u> 840.534.568 <u>5,6090</u> <u>1.681.971.</u>	
<u>59000</u> <u>59</u> 7,1879 <u>1.740.470.500</u> <u>868.745.666</u> <u>5,8150</u> <u>1.740.470</u>	
6,0000 60 7,3211 1.799.970.000 898.431.129 6,0000 1.799.970	
61000 61 6,9580 1.860.469.500 929.060.394 6,3520 1.860.469	
62000 62 7,6433 1.921.969.000 959.368.829 6,7460 1.921.969	
63000 63 7,6496 1.984.468.500 991.700.659 6,7440 1.984.468	
64000         64         7,9099         2.047.968.000         1.021.813.197         6,9330         2.047.968	
65000 65 <b>8</b> ,3919 2.112.467.500 1.054.329.334 7,2320 2.112.467	
66000 66 10,6031 2.177.967.000 1.086.986.726 7,3690 2.177.967	
67000 67 8,9657 2.244.466.500 1.120.072.760 8,3530 2.244.466	
68000 68 10,1968 2.311.966.000 1.154.591.431 8,0520 2.311.966	
69000 69 9,3485 2.380.465.500 1.188.854.334 9,0000 2.380.465	5.500 1.188.854.334
70000 70 9,7441 2.449.965.000 1.223.601.858 8,8570 2.449.965	5.000 1.223.601.858
71000 71 10,2797 2.520.464.500 1.259.251.093 8,8470 2.520.464	
72000 72 12,5161 2.591.964.000 1.295.658.285 9,0050 2.591.964	
73000 73 11,4326 2.664.463.500 1.330.417.968 9,2550 2.664.463	
74000 74 13,3384 2.737.963.000 1.367.942.365 9,9640 2.737.963	
75000 75 12,1017 2.812.462.500 1.404.495.287 9,8380 2.812.462	
76000 76 13,4224 2.887.962.000 1.442.187.087 10,1210 2.887.962	
77000 77 11,9774 2.964.461.500 1.481.024.126 10,9080 2.964.461	
78000 78 12,5675 3.041.961.000 1.521.306.382 10,7260 3.041.961	
79000 79 12,7093 3.120.460.500 1.560.541.286 11,1050 3.120.460	
80000 80 12,7937 3.199.960.000 1.599.509.593 11,7180 3.199.960	
81000 81 13,3335 3.280.459.500 1.640.443.978 11,6340 3.280.455	
82000         82         13,4826         3.361.959.000         1.680.203.437         11,7920         3.361.959	
83000 83 14,3545 3.444.458.500 1.721.653.344 12,6650 3.444.456	
84000 84 14,4911 3.527.958.000 1.763.499.492 12,4290 3.527.958	
85000 85 14,7337 3.612.457.500 1.804.805.070 12,7870 3.612.457	7.500   1.804.805.070
86000 86 14,8292 3.697.957.000 1.846.880.094 13,4660 3.697.95	7.000 1.846.880.094
87000 87 15,4274 3.784.456.500 1.890.325.342 13,3520 3.784.456	6.500 1.890.325.342
88000 88 15,9337 3.871.956.000 1.933.269.992 13,9840 3.871.956	5.000 1.933.269.992
89000 89 16,1453 3.960.455.500 1.977.971.855 14,1880 3.960.455	5.500 1.977.971.855
90000 90 16,1489 4.049.955.000 2.021.930.305 14,8740 4.049.955	
91000 91 16,4967 4.140.454.500 2.068.313.536 15,1990 4.140.454	
92000 92 16,9712 4.231.954.000 2.114.733.624 15,0210 4.231.954	
93000 93 17,6075 4.324.453.500 2.160.658.865 15,8650 4.324.453	
94000 94 19,0317 4.417.953.000 2.208.752.157 16,2360 4.417.953	
95000 95 <b>17,9666</b> 4.512.452.500 2.254.648.528 16,0000 4.512.452	
96000 96 <b>18,4813 4.607.952.000 2.301.719.843 16,5520 4.607.95</b>	
97000 97 18,3330 4.704.451.500 2.350.282.615 16,8910 4.704.451	
98000 98 18,9473 4.801.951.000 2.399.456.147 17,0000 4.801.951	
99000 99 19,4994 4.900.450.500 2.449.781.218 17,8550 4.900.450	0.500 2.449.781.218
<u>100000</u> 100 19,9667 4.999.950.000 2.498.131.957 18,0000 4.999.950	
MÉDIA 6,94 1.691.724.750 845.362.034 5,97 1.691.724	.750 845.362.034

Para os valores Numéricos C++ sai na frente de Golang, considerando a média dos valores, com 0,97 segundos a menos que Golang. Os valores de tempo se mantem muito parelhos a maior parte do tempo, porém no final é possível notar que Golang possui maior variação para valores superiores ao contrário de C++ que se mantem constante em seus valores.

#### **Pessoas**

					PESSOAS			
					BubbleSort			
			Golang				C++	
REGISTROS 1000	TESTES 1	Tempo de Execucao (seg) 0,0026	Contador de Comparacoes 499.500	Contador Swap 249.363		Tempo de Execucao (seg) 0,0160	Contador de Comparacoes 499.500	Contador Swap 249.363
2000	2	0,0085	1.999.000	991.778		0,0150	1.999.000	991.778
3000	3	0,0219	4.498.500	2.197.033		0,0070	4.498.500	2.197.033
4000 5000	4	0,0349 0,0555	7.998.000 12.497.500	3.970.189 6.225.210		0,0310 0,0460	7.998.000 12.497.500	3.970.189 6.225.210
6000	6	0,0856	17.997.000	9.000.675		0,0780	17.997.000	9.000.675
7000	7	0,1161	24.496.500	12.252.603		0,1710	24.496.500	12.252.603
8000	8	0,1657	31.996.000	16.043.789		0,2360	31.996.000	16.043.789
9000 10000	9 10	0,2058 0,2837	40.495.500 49.995.000	20.291.747		0,2960 0,3590	40.495.500 49.995.000	20.291.747
11000	11	0,3270	60.494.500	30.211.293		0,4680	60.494.500	30.211.293
12000	12	0,3980	71.994.000	35.897.442		0,5800	71.994.000	35.897.442
13000	13	0,4649	84.493.500	42.504.676		0,7500	84.493.500	42.504.676
14000	14	0,5380	97.993.000	49.473.330		0,8900	97.993.000 112.492.500	49.473.330
15000 16000	15 16	0,7363 0,7171	112.492.500 127.992.000	56.751.478 64.475.466		1,1150 1,2090	127.992.000	56.751.478 64.475.466
17000	17	0,8355	144.491.500	72.865.418		1,3620	144.491.500	72.865.418
18000	18	0,9292	161.991.000	81.421.593		1,5350	161.991.000	81.421.593
19000	19	1,0373	180.490.500	90.761.494		1,7840	180.490.500	90.761.494
20000 21000	20 21	1,7019 1,2815	199.990.000 220.489.500	100.559.188 110.874.358		1,9120 2,3240	199.990.000 220.489.500	100.559.188 110.874.358
22000	22	1,4913	241.989.000	121.289.119		2,5550	241.989.000	121.289.119
23000	23	1,5436	264.488.500	132.223.859		2,8470	264.488.500	132.223.859
24000	24	1,7049	287.988.000	144.186.647		2,9270	287.988.000	144.186.647
25000	25	1,8636	312.487.500	156.367.252		3,2850	312.487.500	156.367.252
26000	26	1,9570 2,3965	337.987.000 364.486.500	168.951.342		3,7280 3,8670	337.987.000	168.951.342
27000 28000	27 28	2,3512	391.986.000	182.600.921 196.215.409		4,1630	364.486.500 391.986.000	182.600.921 196.215.409
29000	29	2,5425	420.485.500	210.489.582		4,3950	420.485.500	210.489.582
30000	30	2,7101	449.985.000	224.995.283		4,7570	449.985.000	224.995.283
31000	31	2,9246	480.484.500	240.031.006		5,0560	480.484.500	240.031.006
32000 33000	32 33	3,1308 3,3143	511.984.000 544.483.500	256.183.777 272.353.284		5,4280 6,3080	511.984.000 544.483.500	256.183.777 272.353.284
34000	34	3,5356	577.983.000	289.358.238		6,3080	577.983.000	289.358.238
35000	35	3,9459	612.482.500	306.834.786		6,7280	612.482.500	306.834.786
36000	36	4,1824	647.982.000	324.460.359		7,1020	647.982.000	324.460.359
37000	37	4,2400	684.481.500	342.304.796		7,6320	684.481.500	342.304.796
38000 39000	38 39	4,5531 4,7318	721.981.000 760.480.500	361.390.052 380.808.532		8,6030 9,0040	721.981.000 760.480.500	361.390.052 380.808.532
40000	40	5,4974	799.980.000	400.782.731		9,3960	799.980.000	400.782.731
41000	41	5,3384	840.479.500	420.477.937		9,3760	840.479.500	420.477.937
42000	42	5,6266	881.979.000	441.850.475		9,7660	881.979.000	441.850.475
43000 44000	43 44	5,9360 6,3947	924.478.500 967.978.000	463.007.302 484.551.382		10,9480 10,9560	924.478.500 967.978.000	463.007.302 484.551.382
45000	45	6,3795	1.012.477.500	506.667.706		11,3650	1.012.477.500	506.667.706
46000	46	6,8773	1.057.977.000	529.216.910		12,4140	1.057.977.000	529.216.910
47000	47	7,1849	1.104.476.500	551.818.605		12,4950	1.104.476.500	551.818.605
48000	48	7,6103 7.8774	1.151.976.000	575.323.389 599.643.869		12,8740	1.151.976.000	575.323.389 599.643.869
49000 50000	49 50	8,1835	1.200.475.500 1.249.975.000	624.295.565		14,1780 14,1470	1.200.475.500	624.295.565
54000	54	11,6437	1.457.973.000	729.165.306		17,1340	1.457.973.000	729.165.306
55000	55	14,6077	1.512.472.500	756.313.881		18,3090	1.512.472.500	756.313.881
56000	56	11,8892	1.567.972.000	783.469.878		18,6600	1.567.972.000	783.469.878
57000 58000	57 58	11,9471 17.0313	1.624.471.500 1.681.971.000	811.349.800 840.542.810		19,9230 20,4410	1.624.471.500 1.681.971.000	811.349.800 840.542.810
59000	58	11,8655	1.740.470.500	868.754.229		20,9560	1.740.470.500	868.754.229
60000	60	13,3575	1.799.970.000	898.439.973		22,0750	1.799.970.000	898.439.973
61000	61	13,0429	1.860.469.500	929.069.525		22,1720	1.860.469.500	929.069.525
62000	62	13,4361	1.921.969.000	959.378.271		24,0380	1.921.969.000	959.378.271
63000 64000	63 64	13,6376 13,9308	1.984.468.500 2.047.968.000	991.710.420 1.021.823.286		24,2320 24,9180	1.984.468.500 2.047.968.000	991.710.420 1.021.823.286
65000	65	14,6732	2.112.467.500	1.054.339.757		26,4660	2.112.467.500	1.054.339.757
66000	66	15,0436	2.177.967.000	1.086.997.488		26,5250	2.177.967.000	1.086.997.488
67000	67	15,7100	2.244.466.500	1.120.083.839		27,5520	2.244.466.500	1.120.083.839
68000	68 69	16,0868 16,6873	2.311.966.000 2.380.465.500	1.154.602.844 1.188.866.111		28,9830 29,2170	2.311.966.000 2.380.465.500	1.154.602.844 1.188.866.111
69000 70000	70	17,3041	2.380.465.500	1.223.613.977		31,2070	2.449.965.000	1.223.613.977
71000	71	17,7408	2.520.464.500	1.259.263.556		30,9840	2.520.464.500	1.259.263.556
72000	72	18,5752	2.591.964.000	1.295.671.097		32,6030	2.591.964.000	1.295.671.097
73000	73	18,7812	2.664.463.500	1.330.431.147		34,2690	2.664.463.500	1.330.431.147
74000 75000	74 75	19,7932 20,4583	2.737.963.000 2.812.462.500	1.367.955.910 1.404.509.184		34,3130 36,0900	2.737.963.000 2.812.462.500	1.367.955.910 1.404.509.184
76000	76	20,4563	2.887.962.000	1.442.201.418		37,3140	2.887.962.000	1.442.201.418
77000	77	21,4145	2.964.461.500	1.481.038.863		37,7690	2.964.461.500	1.481.038.863
78000	78	22,1889	3.041.961.000	1.521.321.513		38,8540	3.041.961.000	1.521.321.513
79000	79	22,7814	3.120.460.500	1.560.556.798		40,7360	3.120.460.500	1.560.556.798
80000 81000	80 81	23,3831 24,2864	3.199.960.000 3.280.459.500	1.599.525.513 1.640.460.303		41,8190 42,2880	3.199.960.000 3.280.459.500	1.599.525.513
61000	01	LT,2004	J. 200. TJJ. J00	1.040.400.303		12,2000	J.200. 733. 300	1.040.400.303

83000 83 25,5701 3.444.458.500 1.721.670.493 45,3070 3.444.458.500 1.721.670.493 45,3070 3.444.458.500 1.721.670.493 45,5000 84 25,8369 3.527.958.000 1.763.517.087 45,5820 3.527.958.000 1.763.517.087 85000 85 26,3471 3.612.457.500 1.804.823.099 47,0460 3.612.457.500 1.804.823.09 47,0460 3.612.457.500 1.804.823.09 47,4180 3.697.957.000 1.846.898.542 47,4180 3.697.957.000 1.846.898.542 47,4180 3.697.957.000 1.846.898.542 88,000 88 28,8386 3.784.456.500 1.890.344.206 48,9660 3.764.456.500 1.890.344.206 48,9660 3.764.456.500 1.890.344.206 48,9660 3.764.456.500 1.890.344.206 48,9660 3.764.456.500 1.890.344.206 48,9660 3.764.456.500 1.933.283.283.283.283.283.283.283.283.283.2								
84000         84         25,8369         3.527,958.000         1.763.517.087           85000         85         26,3471         3.612,457,500         1.804.823.099         47,0460         3.612,457,500         1.804.823.099           86000         86         27,5983         3.697,957.000         1.846.898.542         47,4180         3.697,957.000         1.846.898.542           87000         87         28,4783         3.784.456.500         1.890.344.206         48,9660         3.784.456.500         1.890.344.206           88000         88         28,8386         3.871.956.000         1.933.289.323         51,7520         3.871.956.000         1.933.289.3           89000         89         29,8846         3.960.455.500         1.977.991.608         51,8580         3.960.455.500         1.977.991.608           91000         90         30,5408         4.049.955.000         2.021.950.536         53,6040         4.049.955.000         2.021.950.536           91000         91         32,0595         4.140.454.500         2.068.334.174         55,5260         4.140.454.500         2.088.334.74           92000         92         32,1465         4.231.954.000         2.114.754.711         57,2410         4.231.954.000         2.114.754.71	82000	82	24,8702	3.361.959.000	1.680.220.172	43,1920	3.361.959.000	1.680.220.172
85000         85         26,3471         3.612.457.500         1.804.823.099         47,0460         3.612.457.500         1.804.823.099           86000         86         27,5383         3.637.957.000         1.846.839.542         47,4480         3.637.957.000         1.846.839.542           87000         87         28,4783         3.784.456.500         1.830.344.206         48,9660         3.784.456.500         1.890.344.20           88000         88         28,8386         3.871.956.000         1.933.283.323         51,7520         3.871.956.000         1.933.283.323           89000         89         29,8846         3.960.455.500         1.977.991.608         51,8580         3.960.455.500         1.977.991.608           90000         90         30,5408         4.049.955.000         2.021.950.536         53,6040         4.049.955.000         2.021.950.5           92000         92         32,1465         4.231.954.000         2.114.754.711         57,2410         4.231.954.000         2.114.754.711           93000         93         32,9188         4.324.453.500         2.160.680.456         59,0100         4.324.453.500         2.160.680.456           94000         94         33,3820         4.417.953.000         2.2254.671.090         60,3220	83000	83	25,5701	3.444.458.500	1.721.670.493	45,3070	3.444.458.500	1.721.670.493
86000         86         27,5983         3.697,957.000         1.846.898.542         47,4180         3.697,957.000         1.846.898.58           87000         87         28,4783         3.784.456.500         1.890.344.206         48,9660         3.784.456.500         1.893.344.206           88000         89         29,8846         3.860.455.500         1.933.289.33         51,7520         3.871.956.000         1.933.289.3           89000         89         29,8846         3.960.455.500         1.977.991.608         51,8580         3.960.455.500         1.977.991.608           90000         90         30,5408         4.049.955.000         2.021.950.536         53,6040         4.049.955.000         2.021.950.5           91000         91         32,0595         4.140.454.500         2.088.334.774         55,5260         4.140.454.500         2.088.334.774           93000         93         32,186         4.231.954.000         2.114.754.711         57,2410         4.231.954.000         2.114.754.711           93000         93         32,9188         4.324.453.500         2.160.680.456         59,0100         4.324.453.500         2.160.680.456           94000         94         33,3820         4.417.953.000         2.2254.671.09         59,4870	84000	84	25,8369	3.527.958.000	1.763.517.087	45,5820	3.527.958.000	1.763.517.087
87000 87 28,4783 3.784.456.500 1.890.344.206 48,9660 3.784.456.500 1.890.344.206 88000 88 28,8386 3.871.956.000 1.933.289.323 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,7520 3.871.956.000 1.933.289.3 51,8580 3.960.455.500 1.977.991.60 53,6040 4.049.955.000 1.932.291.500 91 32,0595 4.140.454.500 2.068.334.744 55,5260 4.140.454.500 2.068.334.744 55,5260 4.140.454.500 2.068.334.744 55,5260 4.140.454.500 2.068.334.744 55,5260 4.140.454.500 2.160.680.456 59,0100 4.224.453.500 2.160.680.456 59,0100 4.224.453.500 2.160.680.456 59,0100 4.324.453.500 2.160.680.456 59,0100 4.324.453.500 2.208.774.219 59,4870 4.417.953.000 2.208.774.219 59,4870 4.417.953.000 2.208.774.219 59,4870 4.417.953.000 2.208.774.219 59,4870 4.607.952.000 2.301.742.89 60,3220 4.512.452.500 2.254.671.0 60,3220 4.512.452.500 2.254.671.0 60,3220 4.512.452.500 2.254.671.0 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.452.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.742.89 60,3220 4.512.502.500 2.301.	85000	85	26,3471	3.612.457.500	1.804.823.099	47,0460	3.612.457.500	1.804.823.099
88000         88         28,8386         3.871.956.000         1.933.289.323         51,7520         3.871.956.000         1.933.289.3           89000         89         29,8846         3.960.455.500         1.977.991.608         51,8580         3.960.455.500         1.977.991.6           90000         90         30,5408         4.049,955.000         2.021.950.536         53,6040         4.049.955.000         2.021.950.536           91000         91         32,0595         4.140.454.500         2.068.334.74         55,5260         4.140.454.500         2.068.334.74           92000         92         32,1465         4.231.954.000         2.114.754.71         57,2410         4.231.954.000         2.114.754.7           93000         93         32,9188         4.924.453.500         2.160.680.456         59,0100         4.224.453.500         2.160.680.456           94000         94         33,3820         4.417.953.000         2.208.774.219         59,4870         4.417.953.000         2.208.774.219           95000         95         34,5758         4.512.452.500         2.254.671.090         60,3220         4.512.452.500         2.254.671.090           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760	86000	86	27,5983	3.697.957.000	1.846.898.542	47,4180	3.697.957.000	1.846.898.542
89000         89         29,8846         3.960.455.500         1.977.991.608         51,8580         3.960.455.500         1.977.991.608           90000         90         30,5408         4.049.955.000         2.021.950.536         53,6040         4.049.955.000         2.021.950.536           91000         91         32,0595         4.140.454.500         2.068.334.174         55,5260         4.140.454.500         2.068.334.7           92000         92         32,1465         4.231.954.000         2.114.754.711         57,2410         4.231.954.000         2.114.754.71           93000         93         32,9188         4.324.453.500         2.160.680.456         59,0100         4.324.453.500         2.160.680.456           94000         94         33,3820         4.417.953.000         2.208.774.219         59,4870         4.417.953.000         2.208.774.2           96000         95         35,1828         4.607.952.000         2.254.671.090         60,3220         4.512.452.500         2.254.671.09           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.153           98000         98         37,4804         4.801.351.000         2.399.480.79         65,3190	87000	87	28,4783	3.784.456.500	1.890.344.206	48,9660	3.784.456.500	1.890.344.206
90000 90 30,5408 4.049.955.000 2.021.950.536 53,6040 4.049.955.000 2.021.950.536 91000 91 32,0595 4.140.454.500 2.068.334.174 55,5260 4.140.454.500 2.068.334.174 92000 92 32,1465 4.231.954.000 2.114.754.71 57,2410 4.231.954.000 2.114.754.71 57,2410 4.231.954.000 2.114.754.71 57,2410 4.231.954.000 2.114.754.71 93000 93 32,9188 4.324.453.500 2.160.680.456 59,0100 4.324.453.500 2.160.680.456 94000 94 33,3320 4.417.953.000 2.208.774.219 59,4870 4.417.953.000 2.208.774.219 95,000 95 34,5758 4.512.452.500 2.254.671.09 60,3220 4.512.452.500 2.254.671.09 60,3220 4.512.452.500 2.254.671.09 96000 96 35,1828 4.607.952.000 2.301.742.898 63,0490 4.607.952.000 2.301.742.898 97,000 97 36,1269 4.704.451.500 2.350.306.153 98000 98 37,4804 4.801.951.000 2.399.480.179 99000 99 38,3347 4.900.450.500 2.449.805.761 68,0350 4.900.450	88000	88	28,8386	3.871.956.000	1.933.289.323	51,7520	3.871.956.000	1.933.289.323
91000 91 32,0595 4.140.454.500 2.068.334.174 55,5260 4.140.454.500 2.068.334. 92000 92 32,1465 4.231.954.000 2.114.754.711 57,2410 4.231.954.000 2.114.754.7 93000 93 32,9188 4.324.453.500 2.160.680.456 59,0100 4.324.553.500 2.160.680.456 94000 94 33,3820 4.417.953.000 2.208.774.219 59,4870 4.417.953.000 2.208.774. 95000 95 34,5758 4.512.452.500 2.254.671.090 60,3220 4.512.452.500 2.254.671.090 96 35,1828 4.607.952.000 2.301.742.89 63,0490 4.607.952.000 2.301.742.89 63,0490 4.607.952.000 2.301.742.89 68,0350 4.704.451.500 2.350.306.153 98000 98 37,4804 4.801.951.000 2.393.480.79 99000 99 38,3347 4.900.450.500 2.449.805.761 68,0350 4.900.450.500 2.449.805.761 100000 100 38,9491 4.999.950.000 2.449.805.700 71,1830 4.999.950.000 2.498.157.002	89000	89	29,8846	3.960.455.500	1.977.991.608	51,8580	3.960.455.500	1.977.991.608
92000         92         32,1465         4.231.954.000         2.114.754.711         57,2410         4.231.954.000         2.114.754.74           93000         93         32,9188         4.324.453.500         2.160.680.456         59,0100         4.324.453.500         2.160.680.680.4           94000         94         33,3820         4.417.953.000         2.208.774.21         59,0100         4.524.453.500         2.208.774.1           95000         95         34,5758         4.512.452.500         2.254.671.090         60,3220         4.512.452.500         2.254.671.090           96000         96         35,1828         4.607.952.000         2.301.742.698         63,0490         4.607.952.000         2.301.742.698           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.           98000         98         37,4804         4.801.951.000         2.393.480.79         65,9190         4.801.951.000         2.393.480.7           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.761           100000         100         38,9491         4.999.950.000         2.449.8157.02         71,1830 <td>90000</td> <td>90</td> <td>30,5408</td> <td>4.049.955.000</td> <td>2.021.950.536</td> <td>53,6040</td> <td>4.049.955.000</td> <td>2.021.950.536</td>	90000	90	30,5408	4.049.955.000	2.021.950.536	53,6040	4.049.955.000	2.021.950.536
93000         93         32,9188         4.324.453.500         2.160.680.456         59,0100         4.324.453.500         2.160.680.4           94000         94         33,3820         4.417.953.000         2.208.774.219         59,4870         4.417.953.000         2.208.774.2           95000         95         35,1828         4.512.452.500         2.254.671.09         60,3220         4.512.452.500         2.254.671.0           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.           98000         98         37,4804         4.801.951.000         2.399.480.179         65,9190         4.801.951.000         2.399.480.           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.           100000         100         38,9491         4.999.950.000         2.448.805.702         71,1830         4.999.950.000         2.498.157.002	91000	91	32,0595	4.140.454.500	2.068.334.174	55,5260	4.140.454.500	2.068.334.174
94000         94         33,3820         4.417.953.000         2.208.774.219         59,4870         4.417.953.000         2.208.774.2           95000         95         34,5758         4.512.452.500         2.254.671.090         60,3220         4.512.452.500         2.254.671.0           96000         96         35,1828         4.607.952.000         2.301.742.898         63,0490         4.607.952.000         2.301.742.89           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.           98000         98         37,4804         4.801.951.000         2.399.480.179         65,9190         4.801.951.000         2.399.480.1           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.904.50.500         2.449.805.1           100000         100         38,9491         4.999.950.000         2.498.157.02         71,1830         4.999.950.000         2.498.157.0	92000	92	32,1465	4.231.954.000	2.114.754.711	57,2410	4.231.954.000	2.114.754.711
95000         95         34,5758         4.512.452.500         2.254.671.090         60,3220         4.512.452.500         2.254.671.090           96000         96         35,1828         4.607.952.000         2.301.742.898         63,0490         4.607.952.000         2.301.742.89           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.           98000         98         37,4804         4.801.951.000         2.399.480.79         65,9190         4.801.951.000         2.394.480.           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.761           100000         100         38,9491         4.999.950.000         2.498.157.002         71,1830         4.999.950.000         2.498.157.0	93000	93	32,9188	4.324.453.500	2.160.680.456	59,0100	4.324.453.500	2.160.680.456
96000         96         35,1828         4.607.952.000         2.301.742.698         63,0490         4.607.952.000         2.301.742.698           97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.306.306.306           98000         98         37,4804         4.801.951.000         2.393.480.179         65,9190         4.801.951.000         2.393.480.306.306.306.306.306.306.306.306.306.30	94000	94	33,3820	4.417.953.000	2.208.774.219	59,4870	4.417.953.000	2.208.774.219
97000         97         36,1269         4.704.451.500         2.350.306.153         65,2760         4.704.451.500         2.350.306.           98000         98         37,4804         4.801.951.000         2.399.480.179         65,9190         4.801.951.000         2.399.480.           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.           100000         100         38,9491         4.999.950.000         2.498.157.02         71,1830         4.999.950.000         2.498.157.0	95000	95	34,5758	4.512.452.500	2.254.671.090	60,3220	4.512.452.500	2.254.671.090
98000         98         37,4804         4.801.951.000         2.393.480.179         65,9190         4.801.951.000         2.399.480.7           99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.7           100000         100         38,9491         4.999.950.000         2.498.157.002         71,1830         4.999.950.000         2.498.157.0	96000	96	35,1828	4.607.952.000	2.301.742.898	63,0490	4.607.952.000	2.301.742.898
99000         99         38,3347         4.900.450.500         2.449.805.761         68,0350         4.900.450.500         2.449.805.761           100000         100         38,9491         4.999.950.000         2.498.157.002         71,1830         4.999.950.000         2.498.157.002	97000	97	36,1269	4.704.451.500	2.350.306.153	65,2760	4.704.451.500	2.350.306.153
100000 100 38,9491 4.999.950.000 2.498.157.002 71,1830 4.999.950.000 2.498.157.00	98000	98	37,4804	4.801.951.000	2.399.480.179	65,9190	4.801.951.000	2.399.480.179
	99000	99	38,3347	4.900.450.500	2.449.805.761	68,0350	4.900.450.500	2.449.805.761
MÉDIO 12 34 1 691 724 750 845 370 414 21 56 1 691 724 750 845 370 414	100000	100	38,9491	4.999.950.000	2.498.157.002	71,1830	4.999.950.000	2.498.157.002
HEDIN 12,34 1.031.124.130 043.310.414 21,30 1.031.124.130 043.310.414		MÉDIA	12,34	1.691.724.750	845.370.414	21,56	1.691.724.750	845.370.414

Golang demonstra claramente uma superioridade em relação a C++ ao ordenar o arquivo pessoas que contem strings e números. Baseado nas medias, Golang se sobressai com 9,22 segundos a menos que C++. É possível perceber que a partir do registro 43.000 C++ possui aproximadamente o dobro do tempo para os testes subsequentes em relação ao Go que mantém seus valores equilibrados.

# **Selectionsort:** Golang x C++

## Nomes

					NOMES				
					SelectionSort				
REGISTROS	TESTES	Tempo de Execucao (seg)	Golang Contador de Comparacoes	Contador Swap		Tamas da Foramos (anal	C++	ControlouSum	
1000	TESTES 1	0,0026	499.500	999		0,0020	Contador de Comparacoes 499.500	Contador Swa	
2000	2	0,0107	1.999.000	1.999	i	0,0120	1.999.000	1.999	
3000	3	0,0346	4.498.500	2.999	i	0,0290	4.498.500	2.999	
4000	4	0,0602	7.998.000	3.999		0,0450	7.998.000	3.999	
5000	5	0,0853	12.497.500	4.999		0,0720	12.497.500	4.999	
6000	6	0,0867	17.997.000	5.999	!	0,1150	17.997.000	5.999	
7000	7	0,1272	24.496.500	6.999		0,1480	24.496.500	6.999	
8000 9000	9	0,1879 0,2268	31.996.000 40.495.500	7.999 8.999		0,2020 0,2440	31.996.000 40.495.500	7.999 8.999	
10000	10	0,2868	49.995.000	9.999	1	0,3150	49.995.000	9.999	
11000	11	0,3468	60.494.500	10.999	-	0,3780	60.494.500	10.999	
12000	12	0,4193	71.994.000	11.999		0,4410	71.994.000	11.999	
13000	13	0,4901	84.493.500	12.999	i	0,5750	84.493.500	12.999	
14000	14	0,6078	97.993.000	13.999	i	0,5740	97.993.000	13.999	
15000	15	0,6412	112.492.500	14.999	i	0,7390	112.492.500	14.999	
16000	16	0,8379	127.992.000	15.999		0,8320	127.992.000	15.999	
17000	17	0,8746	144.491.500	16.999		0,9020	144.491.500	16.999	
18000	18	0,9970	161.991.000	17.999	ļ	0,9900	161.991.000	17.999	
19000	19	1,0453	180.490.500	18.999		1,1150	180.490.500	18.999	
20000	20	1,1755	199.990.000	19.999		1,1830	199.990.000	19.999	
21000 22000	21	1,2957	220.489.500 241.989.000	20.999 21.999		1,3120	220.489.500 241.989.000	20.999	
23000	22	1,3989 1,5488	264.488.500	22.999		1,5760 1,7020	264.488.500	22.999	
24000	24	1,6900	287.988.000	23.999		1,7980	287.988.000	23.999	
25000	25	1,8385	312.487.500	24.999		2,1880	312.487.500	24.999	
26000	26	1,9989	337.987.000	25.999		2,1950	337.987.000	25.999	
27000	27	2,1646	364.486.500	26.999		2,5360	364.486.500	26.999	
28000	28	2,3131	391.986.000	27.999	i	2,4590	391.986.000	27.999	
29000	29	2,5043	420.485.500	28.999	i	2,5450	420.485.500	28.999	
30000	30	2,7021	449.985.000	29.999	i	2,7710	449.985.000	29.999	
31000	31	2,9487	480.484.500	30.999	Ī	2,9060	480.484.500	30.999	
32000	32	3,0902	511.984.000	31.999		3,1020	511.984.000	31.999	
33000	33	3,2536	544.483.500	32.999		3,2880	544.483.500	32.999	
34000	34	3,4986	577.983.000	33.999		3,4550	577.983.000	33.999	
35000	35	3,6855	612.482.500	34.999	!	4,0470	612.482.500	34.999	
36000	36	4,4971	647.982.000	35.999	!	4,0340	647.982.000	35.999	
37000	37	4,1347	684.481.500	36.999		4,1410	684.481.500	36.999	
38000	38	4,3730	721.981.000	37.999	!	4,8210	721.981.000	37.999	
39000 40000	39 40	4,6284 4,9346	760.480.500 799.980.000	38.999 39.999	-	4,7760 4,9680	760.480.500 799.980.000	38.999 39.999	
41000	41	5,1337	840.479.500	40.999		5,0470	840.479.500	40.999	
42000	42	5,4136	881.979.000	41.999		5,7240	881.979.000	41.999	
43000	43	5,6300	924.478.500	42.999	i	5,7120	924.478.500	42.999	
44000	44	5,9874	967.978.000	43.999	i	6,2980	967.978.000	43.999	
45000	45	6,2449	1.012.477.500	44.999	i	6,5130	1.012.477.500	44.999	
46000	46	6,5071	1.057.977.000	45.999		6,6070	1.057.977.000	45.999	
47000	47	6,7571	1.104.476.500	46.999		6,8850	1.104.476.500	46.999	
48000	48	7,1212	1.151.976.000	47.999		7,1740	1.151.976.000	47.999	
49000	49	7,4124	1.200.475.500	48.999		8,0310	1.200.475.500	48.999	
50000	50	7,7035	1.249.975.000	49.999		7,9610	1.249.975.000	49.999	
51000	51	8,1121	1.300.474.500	50.999		8,1270	1.300.474.500	50.999	
52000	52	8,4024	1.351.974.000	51.999		8,3620	1.351.974.000	51.999	
53000	53	8,8179 9,0411	1.404.473.500	52.999		9,2730	1.404.473.500 1.457.973.000	52.999 53.999	
54000 55000	54 55	9,4104	1.457.973.000 1.512.472.500	53.999 54.999		9,1740 9,3810	1.512.472.500	54.999	
56000	56	9,7193	1.567.972.000	55.999		9,7490	1.567.972.000	55.999	
57000	57	10,1594	1.624.471.500	56.999		10,7790	1.624.471.500	56.999	
58000	58	10,5104	1.681.971.000	57.999		10,5350	1.681.971.000	57.999	
59000	59	10,8266	1.740.470.500	58.999		10,8580	1.740.470.500	58.999	
60000	60	11,3401	1.799.970.000	59.999		11,8510	1.799.970.000	59.999	
61000	61	11,8057	1.860.469.500	60.999		11,7120	1.860.469.500	60.999	
62000	62	12,2018	1.921.969.000	61.999		11,9690	1.921.969.000	61.999	
63000	63	12,4336	1.984.468.500	62.999		13,0230	1.984.468.500	62.999	
64000	64	12,9190	2.047.968.000	63.999		12,6640	2.047.968.000	63.999	
65000	65	13,2050	2.112.467.500	64.999		13,4160	2.112.467.500	64.999	
66000	66	13,5854	2.177.967.000	65.999		13,6940	2.177.967.000	65.999	
67000	67	14,1168	2.244.466.500	66.999		14,5290	2.244.466.500	66.999	
68000	68	14,6256	2.311.966.000	67.999		15,2010	2.311.966.000	67.999	
69000	69	15,1428	2.380.465.500	68.999		15,5140	2.380.465.500	68.999	
70000	70	15,7509	2.449.965.000	69.999		15,2560	2.449.965.000	69.999	
71000	71	15,7746	2.520.464.500	70.999		16,2400	2.520.464.500 2.591.964.000	70.999	
72000	72 73	16,4880 16,7677	2.591.964.000 2.664.463.500	71.999 72.999		16,2960 17,1440	2.591.964.000	71.999 72.999	
73000 74000	74	17,3704	2.737.963.000	73.999		17,1780	2.737.963.000	73.999	
75000	75	17,7566	2.812.462.500	74.999		18,1210	2.812.462.500	74.999	
76000	76	18,2145	2.887.962.000	75.999		18,1050	2.887.962.000	75.999	
77000	77	18,7413	2.964.461.500	76.999		19,1820	2.964.461.500	76.999	
78000	78	19,3793	3.041.961.000	77.999		19,0990	3.041.961.000	77.999	
79000	79	20,0346	3.120.460.500	78.999		20,3300	3.120.460.500	78.999	
80000		20,2134	3.199.960.000	79.999		19,9230	3.199.960.000	79.999	

81000	81	20,9959	3.280.459.500	80.999	21,3830	3.280.459.500	80.999
82000	82	21,3211	3.361.959.000	81.999	21,6100	3.361.959.000	81.999
83000	83	22,1139	3.444.458.500	82.999	21,5570	3.444.458.500	82.999
84000	84	22,2542	3.527.958.000	83.999	23,1050	3.527.958.000	83.999
85000	85	23,2144	3.612.457.500	84.999	23,6340	3.612.457.500	84.999
86000	86	23,3968	3.697.957.000	85.999	24,5720	3.697.957.000	85.999
87000	87	24,0808	3.784.456.500	86.999	24,1280	3.784.456.500	86.999
88000	88	24,9235	3.871.956.000	87.999	24,4820	3.871.956.000	87.999
89000	89	25,3624	3.960.455.500	88.999	25,6020	3.960.455.500	88.999
90000	90	25,9373	4.049.955.000	89.999	26,1660	4.049.955.000	89.999
91000	91	26,8226	4.140.454.500	90.999	26,0580	4.140.454.500	90.999
92000	92	27,1627	4.231.954.000	91.999	27,8620	4.231.954.000	91.999
93000	93	27,8638	4.324.453.500	92.999	27,8780	4.324.453.500	92.999
94000	94	30,2030	4.417.953.000	93.999	28,1030	4.417.953.000	93.999
95000	95	31,5478	4.512.452.500	94.999	29,5020	4.512.452.500	94.999
96000	96	29,6161	4.607.952.000	95.999	29,8360	4.607.952.000	95.999
97000	97	30,2272	4.704.451.500	96.999	30,3260	4.704.451.500	96.999
98000	98	30,9607	4.801.951.000	97.999	31,0970	4.801.951.000	97.999
99000	99	31,6079	4.900.450.500	98.999	32,0970	4.900.450.500	98.999
100000	100	32,4241	4.999.950.000	99.999	32,3650	4.999.950.000	99.999
	MÉDIA	10,76	1.691.724.750	50.499	10,84	1.691.724.750	50.499

Golang e C++ possuem praticamente as mesmas médias de tempo, observa-se pequenos picos nos aumentos de tempo para ambas as linguagens em determinados registros. De qualquer forma, C++ sai na frente com 0,08 segundos a menos que Golang.

#### Números

				NUMEROS				
					SelectionSort			
necuernos.	********		Golang				C++	
REGISTROS 1000	TESTES 1	Tempo de Execucao (seg) 0,0011	Contador de Comparacoes 499.500	Contador Swap		Tempo de Execucao (seg) 0,0020	Contador de Comparacoes 499.500	Contador Swa
2000	2	0,0069	1.999.000	1.999	i	0,0030	1.999.000	1.999
3000	3	0,0106	4.498.500	2.999	i	0,0050	4.498.500	2.999
4000	4	0,0193	7.998.000	3.999	Ī	0,0070	7.998.000	3.999
5000	5	0,0265	12.497.500	4.999		0,0080	12.497.500	4.999
6000	6	0,0351	17.997.000	5.999		0,0110	17.997.000	5.999
7000	7	0,0579	24.496.500	6.999		0,0240	24.496.500	6.999
8000 9000	8	0,0572 0,0881	31.996.000 40.495.500	7.999 8.999		0,0290 0,0590	31.996.000 40.495.500	7.999 8.999
10000	10	0,1070	49.995.000	9.999		0,0680	49.995.000	9.999
11000	11	0,1450	60.494.500	10.999	i	0,0860	60.494.500	10.999
12000	12	0,1475	71.994.000	11.999	i	0,0700	71.994.000	11.999
13000	13	0,1945	84.493.500	12.999		0,0520	84.493.500	12.999
14000	14	0,2435	97.993.000	13.999		0,0670	97.993.000	13.999
15000	15	0,2571	112.492.500	14.999		0,0740	112.492.500	14.999
16000	16 17	0,2780	127.992.000 144.491.500	15.999		0,0840 0,0930	127.992.000 144.491.500	15.999
17000 18000	18	0,3289 0,3727	161.991.000	16.999 17.999		0,0330	161.991.000	16.999 17.999
19000	19	0,4220	180.490.500	18.999	i	0,1260	180.490.500	18.999
20000	20	0,4510	199.990.000	19.999		0,1220	199.990.000	19.999
21000	21	0,5274	220.489.500	20.999		0,1420	220.489.500	20.999
22000	22	0,5477	241.989.000	21.999		0,1630	241.989.000	21.999
23000	23	0,6139	264.488.500	22.999		0,1730	264.488.500	22.999
24000	24	0,6451	287.988.000	23.999		0,1910	287.988.000	23.999
25000	25 26	0,6943 0,8040	312.487.500	24.999		0,2060	312.487.500	24.999
26000 27000	27	0,8199	337.987.000 364.486.500	25.999 26.999		0,2260 0,2360	337.987.000 364.486.500	25.999 26.999
28000	28	0,8667	391.986.000	27.999		0,2370	391.986.000	27.999
29000	29	1,0256	420.485.500	28.999	i	0.3620	420.485.500	28.999
30000	30	0,9988	449.985.000	29.999	i	0,2990	449.985.000	29.999
31000	31	1,0916	480.484.500	30.999	i	0,3290	480.484.500	30.999
32000	32	1,1746	511.984.000	31.999		0,4470	511.984.000	31.999
33000	33	1,2365	544.483.500	32.999		0,3460	544.483.500	32.999
34000	34	1,3064	577.983.000	33.999	!	0,4020	577.983.000	33.999
35000	35	1,3699	612.482.500	34.999		0,3930	612.482.500	34.999
36000 37000	36 37	1,4820 1,5820	647.982.000 684.481.500	35.999 36.999		0,4160 0,4450	647.982.000 684.481.500	35.999 36.999
38000	38	1,6927	721.981.000	37.999		0,4970	721.981.000	37.999
39000	39	1,6803	760.480.500	38.999	i	0,5030	760.480.500	38.999
40000	40	1,8235	799.980.000	39.999	i	0,5180	799.980.000	39.999
41000	41	1,9486	840.479.500	40.999	i	0,5910	840.479.500	40.999
42000	42	2,1476	881.979.000	41.999		0,5550	881.979.000	41.999
43000	43	2,3094	924.478.500	42.999	!	0,5850	924.478.500	42.999
44000	44	2,3409	967.978.000	43.999		0,6600	967.978.000	43.999
45000	45 46	2,3210 2,5707	1.012.477.500 1.057.977.000	44.999 45.999		0,6690 0,7220	1.012.477.500 1.057.977.000	44.999 45.999
46000 47000	46	2,5194	1.104.476.500	46.999	•	0,7220	1.104.476.500	46.999
48000	48	2,6223	1.151.976.000	47.999		0,7480	1.151.976.000	47.999
54000	54	3,6730	1.457.973.000	53.999		1,3430	1.457.973.000	53.999
55000	55	3,3843	1.512.472.500	54.999		1,1280	1.512.472.500	54.999
56000	56	3,6666	1.567.972.000	55.999		1,0730	1.567.972.000	55.999
57000	57	3,7533	1.624.471.500	56.999		1,1390	1.624.471.500	56.999
58000	58	4,1276	1.681.971.000	57.999		1,1080	1.681.971.000	57.999
59000	59	3,9631	1.740.470.500	58.999		1,1980	1.740.470.500	58.999
60000	60	4,2808	1.799.970.000	59.999		1,2460	1.799.970.000	59.999
61000	61	4,1786	1.860.469.500	60.999		1,1940 1,2080	1.860.469.500	60.999
62000 63000	62 63	4,4271 4,6073	1.921.969.000	61.999 62.999		1,2860	1.921.969.000 1.984.468.500	61.999 62.999
64000	64	4,8295	2.047.968.000	63.999		1,3260	2.047.968.000	63.999
65000	65	4,8809	2.112.467.500	64.999		1,3490	2.112.467.500	64.999
66000	66	5,0874	2.177.967.000	65.999		1,4070	2.177.967.000	65.999
67000		5,3638	2.244.466.500	66.999		1,4590	2.244.466.500	66.999
68000	68	5,5727	2.311.966.000	67.999		1,5270	2.311.966.000	67.999
69000	69	5,3462	2.380.465.500	68.999		1,5560	2.380.465.500	68.999
70000	70	5,7190	2.449.965.000	69.999		1,5630	2.449.965.000	69.999
71000	71	5,7908	2.520.464.500	70.999		1,7070	2.520.464.500	70.999
72000	72	5,8852	2.591.964.000	71.999		1,6910	2.591.964.000	71.999
73000	73	6,3011	2.664.463.500	72.999		1,7660	2.664.463.500	72.999
74000 75000	74 75	6,0783 6,5338	2.737.963.000 2.812.462.500	73.999 74.999		1,7430 1,8280	2.737.963.000 2.812.462.500	73.999 74.999
76000 76000	76	6,5512	2.887.962.000	75.999		2,4130	2.887.962.000	75.999
77000	77	6,9785	2.964.461.500	76.999		2,3310	2.964.461.500	76.999
78000	78	7,1415	3.041.961.000	77.999		2,0500	3.041.961.000	77.999
79000	79	7,0612	3.120.460.500	78.999		2,0630	3.120.460.500	78.999
80000	80	7,5290	3.199.960.000	79.999		2,1190	3.199.960.000	79.999
81000	81	7,6366	3.280.459.500	80.999		2,1380	3.280.459.500	80.999

82000	82	7,8792	3.361.959.000	81.999	2,1860	3.361.959.000	81.999
83000	83	7,7157	3.444.458.500	82.999	2,2950	3.444.458.500	82.999
84000	84	15,6163	3.527.958.000	83.999	2,3310	3.527.958.000	83.999
85000	85	8,3028	3.612.457.500	84.999	2,3840	3.612.457.500	84.999
86000	86	8,6216	3.697.957.000	85.999	2,3620	3.697.957.000	85.999
87000	87	8,5874	3.784.456.500	86.999	2,5120	3.784.456.500	86.999
88000	88	8,9502	3.871.956.000	87.999	2,5190	3.871.956.000	87.999
89000	89	9,0450	3.960.455.500	88.999	2,5980	3.960.455.500	88.999
90000	90	9,2062	4.049.955.000	89.999	3,0280	4.049.955.000	89.999
91000	91	10,5358	4.140.454.500	90.999	3,2440	4.140.454.500	90.999
92000	92	10,7955	4.231.954.000	91.999	2,8570	4.231.954.000	91.999
93000	93	10,3495	4.324.453.500	92.999	2,8650	4.324.453.500	92.999
94000	94	10,4558	4.417.953.000	93.999	2,8780	4.417.953.000	93.999
95000	95	11,1834	4.512.452.500	94.999	3,4750	4.512.452.500	94.999
96000	96	10,6409	4.607.952.000	95.999	3,5270	4.607.952.000	95.999
97000	97	10,8964	4.704.451.500	96.999	3,2060	4.704.451.500	96.999
98000	98	11,1350	4.801.951.000	97.999	3,2750	4.801.951.000	97.999
99000	99	11,3461	4.900.450.500	98.999	3,1810	4.900.450.500	98.999
100000	100	11,3418	4.999.950.000	99.999	3,1950	4.999.950.000	99.999
	MÉDIA	4,02	1.691.724.750	50.499	1,15	1.691.724.750	50.499

A partir do registro 54.000 os valores de tempo de Go aumentam notoriamente em relação a C++ que mantém seus baixos valores de forma constante, sendo que para o registro de 100.000 Golang demora aproximadamente 3x mais que C++ para ordenar os valores numéricos. C++ sai em clara vantagem com 8,1468 baseado na média.

## Pessoas

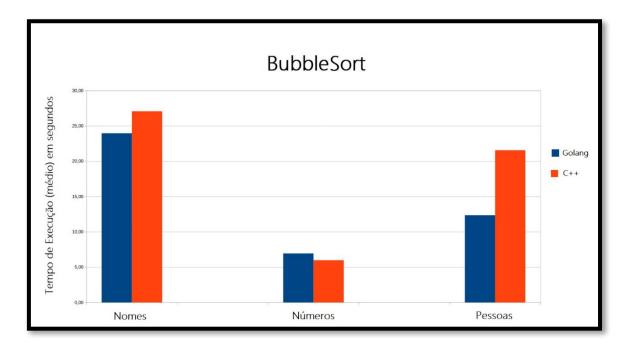
					PESSOAS			
					SelectionSort			
			Golang				C++	_
REGISTROS	TESTES	Tempo de Execucao (seg)	Contador de Comparacoes	Contador Swap		Tempo de Execucao (seg)	Contador de Comparacoes	Contador Swap
1000	1	0,0011	499.500	999		0,0010	499.500	999
2000	2	0,0042	1.999.000	1.999		0,0020	1.999.000	1.999
3000	3	0,0095	4.498.500	2.999		0,0050	4.498.500	2.999
4000	4	0,0237	7.998.000	3.999		0,0070	7.998.000	3.999
5000	5	0,0258	12.497.500	4.999		0,0120	12.497.500	4.999
6000		0,0361	17.997.000	5.999		0,0160	17.997.000	5.999
7000	7	0,0452	24.496.500	6.999		0,0220	24.496.500	6.999
8000	8	0,0648	31.996.000	7.999		0,0330	31.996.000	7.999
9000	9	0,0832	40.495.500	8.999		0,0500	40.495.500	8.999
10000	10	0,1044	49.995.000	9.999		0,0810	49.995.000	9.999
11000	11	0,1339	60.494.500	10.999		0,1610	60.494.500	10.999
12000	12	0,1537	71.994.000	11.999		0,1870	71.994.000	11.999
13000	13	0,1843	84.493.500	12.999		0,1230	84.493.500	12.999
14000	14	0,2226	97.993.000	13.999		0,1410	97.993.000	13.999
15000	15	0,2523	112.492.500	14.999		0,1230	112.492.500	14.999
16000	16	0,2858	127.992.000	15.999		0,1630	127.992.000	15.999
17000	17	0,3323	144.491.500	16.999		0,1680	144.491.500	16.999
18000	18	0,3734	161.991.000	17.999		0,2060	161.991.000	17.999
19000	19	0,4164	180.490.500	18.999		0,2360	180.490.500	18.999
20000	20	0,4600	199.990.000	19.999		0,2190	199.990.000	19.999
21000	21	0,5057	220.489.500	20.999		0,2580	220.489.500	20.999
22000	22	0,5058	241.989.000	21.999		0,2440	241.989.000	21.999
23000	23	0,5919	264.488.500	22.999		0,2710	264.488.500	22.999
24000	24	0,6661	287.988.000	23.999		0,2890	287.988.000	23.999
25000	25	0,6814	312.487.500	24.999		0,3100	312.487.500	24.999
26000	26	0,7535	337.987.000	25.999		0,3340	337.987.000	25.999
27000	27	0,8217	364.486.500	26.999		0,3690	364.486.500	26.999
28000	28	0,8758	391.986.000	27.999		0,4380	391.986.000	27.999
29000	29	0,9681	420.485.500	28.999		0,4750	420.485.500	28.999
30000	30	1,0329	449.985.000	29.999		0,4810	449.985.000	29.999
31000	31	1,0727	480.484.500	30.999		0,4780	480.484.500	30.999
32000	32	1,1835	511.984.000	31.999		0,6250	511.984.000	31.999
33000	33	1,1971	544.483.500	32.999		0,5740	544.483.500	32.999
34000	34	1,2967	577.983.000	33.999		0,6130	577.983.000	33.999
35000	35	1,3696	612.482.500	34.999		0,6390	612.482.500	34.999
36000	36	1,4541	647.982.000	35.999		0,7110	647.982.000	35.999
37000	37	1,5702	684.481.500	36.999		1,0390	684.481.500	36.999
38000	38	1,6021	721.981.000	37.999		0,8730	721.981.000	37.999
39000	39	1,7222	760.480.500	38.999		0,8190	760.480.500	38.999
40000	40	1,7701	799.980.000	39.999		0,8670	799.980.000	39.999
41000	41	1,8324	840.479.500	40.999		0,8330	840.479.500	40.999
42000	42	2,0279	881.979.000	41.999		0,9410	881.979.000	41.999
43000	43	2,1073	924.478.500	42.999		0,9460	924.478.500	42.999
44000	44	2,1882	967.978.000	43.999		1,0540	967.978.000	43.999
45000	45	2,3013	1.012.477.500	44.999		1,1090	1.012.477.500	44.999
46000	46	2,4311	1.057.977.000	45.999		1,2160	1.057.977.000	45.999
47000	47	2,5219	1.104.476.500	46.999		1,1090	1.104.476.500	46.999
48000	48	2,5544	1.151.976.000	47.999		1,1680	1.151.976.000	47.999
49000	49	2,5940	1.200.475.500	48.999		1,2000	1.200.475.500	48.999
50000	50	2,7599	1.249.975.000	49.999		1,2780	1.249.975.000	49.999
51000	51	2,9662	1.300.474.500	50.999		1,3860	1.300.474.500	50.999
52000	52	2,9094	1.351.974.000	51.999		1,4520	1.351.974.000	51.999
53000	53	3,1344	1.404.473.500	52.999		1,4070	1.404.473.500	52.999
54000	54	3,3423	1.457.973.000	53.999		1,3710	1.457.973.000	53.999

1,5230   1,567,372,000   55,393   1,5230   1,5230   1,567,372,001   1,573,77000   57,77000   57,75000   58,593   1,5230   1,523	55000	55	3,3702	1.512.472.500	54.999		1,4170	1 E12 472 E0
57000         57         3,5329         1,624,471,500         \$6,999         1,6550         1,624,471,500         \$7,939         1,7080         1,681,971,000         \$7,939         1,7080         1,7200         1,740,470,500         \$5,939         1,7200         1,740,470,500         \$1,939         1,7200         1,740,470,500         \$1,939         1,7200         1,740,470,500         \$1,939         1,7200         1,740,470,500         \$1,939,700,000         \$1,939         1,7100         \$1,444         1,660,463,500         \$6,939         2,3840         1,521,959,000         \$1,939         2,3840         1,521,959,000         \$1,939         2,3840         1,521,959,000         \$1,939         2,3840         1,521,959,000         \$1,939         2,1340         2,047,968,000         \$3,939         2,1240         2,047,968,000         \$3,939         2,2450         2,112,467,500         \$4,936         \$4,6566         2,047,968,000         \$6,399         2,2370         2,117,967,000         \$6,399         2,2370         2,117,967,000         \$6,399         2,2370         2,117,967,000         \$6,399         2,2370         2,217,967,000         \$6,399         2,2370         2,217,967,000         \$6,399         2,3700         2,311,966,000         \$6,399         2,3700         2,311,966,000         \$6,399         2,3								1.512.472.50
58000         58         3,8338         1,681,971,000         57,999         1,7080         1,681,971,000         1,7080         1,681,971,000         1,7080         1,710,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,708,000         1,939,900         2,3840         1,931,000								
58000         59         3,8422         1,740,470,500         58,999         1,7200         1,740,470,500           50000         61         4,1444         1,789,970,000         59,999         1,1710         1,860,483,500           52000         61         4,1444         1,860,483,500         61,993         2,3840         1,921,963,000           58000         63         4,5015         1,394,466,500         62,993         2,1340         1,964,665,500           58000         64         4,6866         2,047,968,000         63,999         2,2150         2,112,467,500           56000         64         4,6866         2,112,467,500         64,999         2,2770         2,117,967,000           66000         66         4,8604         2,117,967,000         65,999         2,2370         2,177,967,000           76000         67         4,9277         2,244,466,500         68,999         2,3700         2,311,966,000           76000         69         5,1016         2,311,966,000         68,999         2,4770         2,443,965,000           76000         70         5,3228         2,449,965,000         69,999         2,4770         2,449,965,000           710000         71         5,8297								
1,7250   1,739,770,000   53,939   1,7250   1,739,970,000   53,000   61								
53000         61         4,1444         1,860,489,500         60,999         1,9110         1,860,489,500         1,931         1,951,000         61         2,2542         1,921,985,000         61,939         2,3840         1,921,985,000         1,939         2,1340         1,984,486,500         1,939         2,1240         2,047,986,000         63,999         2,2130         2,047,986,000         64,9866         2,147,486,500         64,999         2,2150         2,112,467,500         66,999         2,2270         2,117,967,000         65,999         2,2370         2,177,967,000         65,999         2,2370         2,177,967,000         66,999         2,2370         2,177,967,000         66,999         2,2370         2,177,967,000         66,999         2,2370         2,177,967,000         66,999         2,2370         2,177,967,000         66,999         2,2370         2,177,967,000         66,999         2,2370         2,113,966,000         66,999         2,2370         2,311,966,000         68,999         2,2370         2,311,966,000         76,999         2,24430         2,304,865,500         68,939         2,4470         2,443,985,00         68,939         2,4470         2,443,985,00         69,939         2,501,864,865,500         76,999         2,501,864,865,500         76,999         2,501,864,865,500	59000							
52000         62         4,2542         1,921,969,000         61,939         2,3840         1,921,969,000         1,934,468,500         62,939         2,1340         1,921,969,000         1,934,468,500         62,939         2,1240         2,047,968,000         63,939         2,1240         2,047,968,000         2,047,968,000         63,939         2,2150         2,112,467,500         2,047,968,000         63,939         2,2170         2,117,667,500         64,939         2,2370         2,117,967,000         67,770         2,244,466,500         66,939         2,2630         2,244,466,500         67,939         2,2370         2,117,967,000         67,939         2,2370         2,117,967,000         67,939         2,2630         2,244,466,50         66,939         2,2630         2,244,466,50         66,939         2,2630         2,244,466,50         66,939         2,4770         2,443,985,000         69,939         2,4770         2,443,985,000         69,939         2,4770         2,443,985,000         73,939         2,6010         2,521,864,500         73,939         2,6010         2,521,864,500         73,939         2,6010         2,521,864,500         73,939         3,0510         2,737,963,000         73,939         3,0510         2,737,963,000         73,9399         3,0510         2,737,963,000         73,9399 <td>60000</td> <td>60</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	60000	60						
63000         63         4,5015         1,984,468,500         62,399         2,1340         1,884,668,500         1,884,668,500         63,999         2,1240         2,047,368,000         63,999         2,1240         2,047,368,000         65,999         2,2150         2,217,000         2,112,467,500         65,999         2,2370         2,177,967,000         2,177,967,000         65,999         2,2370         2,177,967,000         2,000         2,000         2,2630         2,244,466,500         68,999         2,3700         2,311,966,000         67,999         2,3700         2,311,966,000         67,999         2,3700         2,311,966,000         2,300,465,500         68,999         2,4330         2,380,465,500         68,999         2,4330         2,380,465,500         69,999         2,4340         2,380,465,500         69,999         2,4770         2,443,965,000         70,999         2,4770         2,443,965,000         70,999         2,4770         2,443,965,000         70,999         2,501,645,500         70,999         2,501,645,500         70,999         2,501,645,500         70,999         2,501,645,500         70,999         3,0030         2,564,465,500         70,999         3,0030         2,564,465,500         70,999         3,0580         2,512,462,500         70,999         3,0580         2,512,462,500<	61000	61		1.860.469.500	60.999			1.860.469.500
54000         64         4,9566         2,047,368,000         63,399         2,1240         2,047,368,00         55000         65         4,6760         2,112,467,500         64,399         2,2150         2,2170         2,177,367,00         56,500         66         4,8604         2,177,967,000         65,599         2,2370         2,777,967,007         2,477,667,000         67         4,9277         2,244,466,500         66,599         2,2630         2,244,466,500         68,599         2,23700         2,311,966,000         2,311,966,000         67,399         2,3700         2,311,966,000         2,311,966,000         67,399         2,4770         2,444,965,500         68,399         2,4770         2,444,965,500         68,399         2,4770         2,444,965,500         70,399         2,5010         2,521,464,500         70,399         2,5010         2,521,464,500         70,399         2,5010         2,521,464,500         70,399         2,5010         2,521,464,500         70,399         3,000         3,59496         2,581,964,000         71,399         3,000         3,59496         2,684,463,500         72,399         3,000         3,5510         2,373,963,000         73,393         3,0510         2,373,963,00         73,393,000         73,393,000         3,3580         2,887,362,000         73,393	62000	62	4,2542	1.921.969.000	61.999		2,3840	1.921.969.000
656000         65         4,6760         2,112,467,500         64,999         2,2150         2,112,467,500         67,500         66         4,8604         2,177,967,000         65,393         2,2370         2,177,967,000         67,700         67,700         67,49277         2,244,466,500         66,999         2,2630         2,244,466,500         86,999         2,2630         2,244,466,500         2,311,966,000         67,999         2,2700         2,311,966,000         2,311,966,000         67,999         2,2700         2,311,966,000         2,311,966,000         68,999         2,4430         2,321,346,550         2,301,445,300         2,399         2,4470         2,443,985,000         2,591,500         2,591,500         2,591,500         2,591,500         2,591,500         2,591,646,500         70,999         2,6990         2,591,646,500         71,999         2,6990         2,591,646,500         71,999         3,0510         2,273,763,000         73,999         3,0510         2,273,763,000         73,999         3,0510         2,273,763,000         73,999         3,0510         2,273,763,000         73,963,000         73,999         3,0510         2,273,963,000         73,999         3,0500         74,993         3,9680         2,887,962,000         75,5999         3,0580         2,887,962,000         76,5999 <td>63000</td> <td>63</td> <td>4,5015</td> <td>1.984.468.500</td> <td>62.999</td> <td></td> <td>2,1340</td> <td>1.984.468.500</td>	63000	63	4,5015	1.984.468.500	62.999		2,1340	1.984.468.500
66000         66         4,8604         2,177,967,000         65,999         2,2370         2,217,967,000         2,775,900         67         4,9277         2,244,466,500         66,999         2,2630         2,244,466,500         2,380,485,500         2,311,966,000         2,443,965,000         2,311,966,000         2,443,965,000         2,311,966,000         2,443,965,000         2,511,964,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         2,511,964,000         3,000         3,000         2,511,964,000         3,000         3,000         2,511,964,000         3,000         3,000	64000	64	4,6966	2.047.968.000	63.999	i	2,1240	2.047.968.00
677000         67         4,9277         2,244,466,500         66,939         2,2630         2,244,466,50         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,3710         2,380,465,50         68,999         2,443         2,380,465,50         68,999         2,4470         2,449,965,00         70,999         2,6010         2,522,464,50         70,999         2,6010         2,520,464,50         70,999         2,6010         2,520,464,50         70,999         2,6010         2,520,464,50         70,999         3,0030         2,664,603,50         71,999         3,0030         2,664,603,50         72,999         3,0030         2,664,463,50         72,999         3,0030         2,664,463,50         72,999         3,0030         2,664,463,50         72,999         3,0510         2,373,963,00         73,983,00         73,983,00         73,983,00         73,983,00         73,983,00         73,983,00         73,983,00         73,983,00         74,999         3,0560         2,812,462,500         74,999         3,0560         2,864,461,500         76,999         3,0560         2,864,461,500         76,999         3,0990         3,041,961,000         77,999         3,0990         3,041,961,000         78,999	65000	65	4,6760	2.112.467.500	64.999		2,2150	2.112.467.500
58000         68         5,1016         2,311,966,000         67,999         2,3700         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,443,985,00         2,443,985,00         2,443,985,00         2,449,985,00         2,449,985,00         2,449,985,00         2,449,985,00         2,520,464,50         7,5299         2,6010         2,520,464,50         2,520,464,50         7,5399         3,0303         2,664,463,50         7,5399         3,0303         2,664,463,50         7,5399         3,0510         2,737,963,00         7,5399         3,0510         2,737,963,00         7,5000         7,56,2133         2,812,462,500         74,999         3,9680         2,867,962,00         7,5999         3,9680         2,867,962,00         7,5999         3,9680         2,867,962,00         7,5999         3,0580         2,864,461,500         7,999         3,0580         2,864,461,500         7,999         3,0580         2,864,461,500         7,999         3,0580         2,864,461,500         7,999         3,0590         3,2410         3,120,460,500         3,769,990         3,1500         3,2410         3,120,460,500         3,999         3,1500         3,280,455,500         3,999	66000	66	4,8604	2.177.967.000	65.999		2,2370	2.177.967.00
58000         68         5,1016         2,311,966,000         67,999         2,3700         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,311,966,000         2,443         2,311,966,000         2,443,985,00         2,443,985,00         2,443,985,00         2,449,985,00         2,449,985,00         2,449,985,00         2,449,985,00         2,520,464,500         70,999         2,6010         2,520,464,500         2,520,464,500         71,999         3,0030         2,664,463,500         72,999         3,0030         2,664,463,500         72,999         3,0030         2,664,463,500         72,999         3,0510         2,737,963,00         73,999         3,9680         2,812,462,500         74,999         3,9680         2,812,462,500         74,999         3,9680         2,887,962,00         76,666089         2,887,962,000         75,999         3,9680         2,887,962,00         77,999         3,0880         2,884,461,500         78,999         3,0880         2,884,461,500         78,999         3,0880         2,884,461,500         78,999         3,0990         3,0860         2,884,461,500         78,999         3,3510         3,3520         3,193,600         3,280,459,500         89,999         3,1500         3,280,459,500         89,999	67000	67	4.9277	2.244.466.500	66.999		2.2630	2.244.466.50
1,500.00   59   5,2806   2,380,485,500   68,399   2,4430   2,380,465,500   70,000   70,000   71,000   71,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   72,000   73,000   73,000   73,000   73,000   73,000   73,000   73,000   73,000   74,000								
1000   70   5,3228   2,449,965,000   69,999   2,4770   2,449,965,00   2,500,464,500   70,999   2,6010   2,520,464,500   70,999   2,6010   2,520,464,500   70,999   2,6990   2,591,964,000   71,993   2,6990   2,591,964,000   73,593   3,0030   2,664,463,500   72,999   3,0030   2,664,463,500   72,999   3,0030   2,664,463,500   74,62777   2,737,963,000   73,999   3,9680   2,812,462,500   74,999   3,9680   2,812,462,500   74,999   3,9680   2,812,462,500   74,999   3,9680   2,812,462,500   74,999   3,9680   2,812,462,500   75,999   3,9080   2,812,462,500   76,999   3,9080   2,812,462,500   77,999   3,0990   3,0590   2,964,461,500   77,999   3,0990   3,041,961,000   77,999   3,0990   3,2410   3,120,460,500   77,999   3,2410   3,120,460,500   77,999   3,2410   3,120,460,500   78,999   3,2410   3,120,460,500   78,999   3,2410   3,120,460,500   78,999   3,2520   3,199,960,000   79,67827   3,120,460,500   78,999   3,2520   3,199,960,000   79,999   3,2520   3,199,960,000   79,999   3,2520   3,199,960,000   79,999   3,2520   3,199,960,000   79,999   3,2520   3,199,960,000   79,999   3,2520   3,199,960,000   3,260,459,550   3,260,459,550   3,260,450,550   3,260,450,550   3,260,450,550   3,260,450,550   3,260,								
21000         71         5,8297         2,520,464,500         70,999         2,6990         2,520,464,500           272000         72         5,6952         2,591,964,000         71,993         2,6990         2,531,964,000           273000         73         5,9496         2,664,463,500         72,999         3,0510         2,737,963,000           275000         74         6,2777         2,737,963,000         73,999         3,0510         2,737,963,000           276000         76         6,6089         2,867,952,000         75,999         3,0580         2,814,462,500           277000         77         6,4158         2,964,461,500         76,999         3,0580         2,864,461,500           28000         78         6,7330         3,041,961,000         77,999         3,0580         2,864,461,500           29000         79         6,7827         3,120,460,500         78,999         3,2410         3,120,460,500           31000         81         7,2164         3,280,459,500         80,999         3,3510         3,3510         3,361,959,000           32000         82         7,7228         3,361,959,000         81,999         3,960         3,444,458,500           33000         83								
72000         72         5,8952         2,591,964,000         71,999         2,6990         2,591,964,000           73000         73         5,9486         2,664,463,500         72,999         3,0030         2,664,463,501           75000         75         6,2717         2,737,963,000         73,999         3,9680         2,812,462,500           75000         75         6,2139         2,812,462,500         74,999         3,9680         2,812,462,500           76000         76         6,6893         2,887,962,000         75,999         3,0580         2,887,962,000           78000         78         6,7330         3,041,961,000         77,999         3,0990         3,041,961,000           78000         78         6,7827         3,120,460,500         78,999         3,2410         3,120,460,500           81000         81         7,2164         3,280,459,500         80,999         3,1500         3,280,459,500           81000         81         7,7298         3,361,959,000         81,999         3,3510         3,361,959,000           81000         83         7,5885         3,444,456,500         82,999         3,7610         3,527,958,000           81000         84         8,0463								
13000         73         5,9496         2,664,463,500         72,999         3,0030         2,664,463,50           14000         74         6,2777         2,737,963,000         73,999         3,0510         2,737,963,00           15000         75         6,2139         2,812,462,500         74,999         3,9680         2,812,462,500           16000         76         6,6099         2,867,962,000         75,999         3,0980         2,867,362,00           17000         77         6,4158         2,964,461,500         76,999         3,0580         2,964,461,500           18000         78         6,7330         3,041,961,000         77,999         3,0990         3,041,961,000           18000         78         6,7330         3,199,960,000         79,999         3,2410         3,120,460,500           18000         81         7,2164         3,280,455,500         80,999         3,3510         3,3510         3,361,959,000           181000         81         7,2184         3,261,550,000         81,999         3,3510         3,361,959,000         3,361,959,000         3,361,959,000         3,999         3,3610         3,527,958,000         3,399         3,7610         3,527,958,000         3,999         3,9690								
74000         74         6,2777         2,737,963,000         73,999         3,0510         2,737,963,00         2,737,963,00         75,500         75         6,2139         2,812,462,500         74,999         3,9680         2,812,462,500         76,999         3,9080         2,812,462,500         77,999         3,9080         2,862,600         77,999         3,9080         2,864,461,500         77,999         3,0580         2,964,461,500         78,999         3,0580         2,964,461,500         78,999         3,0580         2,964,461,500         78,999         3,0930         3,041,961,000         79,999         3,0930         3,041,961,000         79,999         3,2410         3,120,460,500         78,999         3,2410         3,120,460,500         78,999         3,2410         3,120,460,500         78,999         3,3520         3,199,960,000         79,999         3,3520         3,199,960,000         79,999         3,3510         3,280,459,500         3,199,960,000         79,999         3,3510         3,280,459,500         3,199,960,000         3,999         3,3510         3,280,459,500         3,199,960,000         3,199,960,000         3,999         3,3510         3,361,959,000         3,999         3,3510         3,361,959,000         3,999         3,3510         3,361,959,000         3,999 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
76000         76         6,6089         2,887,962,000         75,999         3,9080         2,887,962,00           77000         77         6,4158         2,964,461,500         76,999         3,0580         2,964,461,50           88000         78         6,7330         3,041,961,000         77,999         3,0990         3,041,961,000           99000         79         6,7827         3,120,460,500         78,999         3,2410         3,120,460,500           99000         80         6,8839         3,193,960,000         79,999         3,3520         3,193,980,00           10000         81         7,2164         3,280,459,500         80,999         3,3510         3,280,459,500           12000         82         7,7298         3,361,959,000         81,999         3,3510         3,361,959,00           14000         84         8,0463         3,527,958,000         83,999         3,3510         3,361,959,00           15000         85         8,0333         3,612,457,500         84,999         3,3580         3,687,957,000           16000         86         8,4709         3,587,957,000         85,999         3,3980         3,687,957,000           17000         87         8,6901         3								
7700 77 6,4158 2.964.461.500 76.999 3,0580 2.964.461.500 78.999 3,0580 2.964.461.500 78.67330 3.041.961.000 77.999 3,0990 3.041.961.000 98.6,8339 3.120.460.500 78.999 3,3520 3.193.960.000 98.6,8839 3.193.960.000 79.999 3,3550 3.361.959.000 81.7,2164 3.280.459.500 80.999 3,3550 3.361.959.000 82.7,7298 3.361.959.000 81.999 3,3550 3.361.959.000 82.7,7298 3.361.959.000 81.999 3,3550 3.361.959.000 81.999 3,3550 3.361.959.000 81.999 3,3550 3.361.959.000 82.999 4.6690 3.444.458.500 82.999 4.6690 3.444.458.500 82.999 3.7610 3.527.958.000 83.999 3.7610 3.527.958.000 83.999 3.9990 3.612.457.500 84.999 3.9980 3.612.457.500 86.999 3.9980 3.9990 3.9890 3.612.457.500 86.999 3.9980 3.9990 3.9980 3.897.957.000 87.999 3.9980 3.897.957.000 87.999 3.9880 3.871.956.000 88.8,9404 3.871.956.000 87.999 3.9880 3.871.956.000 88.999 3.9901 3.960.455.500 86.999 3.9990 3.9890 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9890 3.9600 3.9800 3.871.956.000 87.999 3.9880 3.871.956.000 88.999 3.9880 3.871.956.000 88.999 3.9880 3.871.956.000 88.999 3.9880 3.871.956.000 88.999 3.9880 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.9800 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 88.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.871.956.000 89.999 3.9860 3.899 3.9899 3.9860 3.871.956.000 89.								
8000         78         6,7330         3.041,961,000         77,999         3,0990         3.041,961,000           9000         79         6,7827         3.120,460,500         78,999         3,2410         3.120,460,500           9000         80         6,8839         3,199,960,000         79,999         3,3520         3,199,960,000           1000         81         7,2164         3,280,459,500         80,999         3,1500         3,280,459,50           3000         82         7,7298         3,361,959,000         81,993         3,3510         3,35150         3,361,959,00           3000         83         7,5885         3,444,458,500         82,999         4,6690         3,444,458,500           4000         84         8,0463         3,527,958,000         83,999         3,7610         3,527,958,00           5000         85         8,0333         3,612,457,500         84,999         3,9690         3,612,457,500           6600         86         8,4703         3,687,957,000         85,993         3,9980         3,697,957,000           700         87         8,6901         3,784,456,500         86,993         4,0010         3,784,456,500           8000         88         3,9404 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
9000 79 6,7827 3,120,460,500 78,999 3,2410 3,120,460,500 0000 80 6,8839 3,199,560,000 73,999 3,3520 3,199,800,000 1000 81 7,2164 3,280,459,500 80,999 3,1500 3,280,459,500 2000 82 7,7298 3,361,959,000 81,999 3,3510 3,361,959,000 4000 84 8,0463 3,527,958,000 82,999 4,6690 3,444,458,500 4000 85 8,0933 3,612,457,500 84,999 3,9690 3,612,457,500 6000 86 8,4709 3,897,957,000 85,999 3,9690 3,612,457,500 6000 86 8,4709 3,897,957,000 85,999 3,9880 3,637,957,000 7000 87 8,6901 3,784,456,500 86,999 4,0010 3,784,456,500 8000 88 9,4904 3,871,956,000 87,999 3,9880 3,871,956,000 8000 89 9,0901 3,960,455,500 88,999 4,0010 3,784,456,500 6000 90 90 9,2650 4,049,955,000 83,999 4,0590 4,0590 4,049,955,000 6000 90 9,2650 4,049,955,000 83,999 4,0590 4,0590 4,049,955,000 6000 90 9,3650 4,049,955,000 83,999 4,0590 4,0590 4,049,955,000 6000 90 9,3650 4,049,955,000 83,999 5,1950 4,049,955,000 6000 90 9,3650 4,049,955,000 81,999 5,4480 4,231,954,000 6000 90 90 90 90 90 90 90 90 90 90 90 90								
0000         80         6,8839         3,199,960,000         79,999         3,3520         3,199,960,000           1000         81         7,2164         3,280,459,500         80,999         3,1500         3,280,459,500           2000         82         7,7298         3,361,959,000         81,999         3,3510         3,361,959,500           3000         83         7,5885         3,444,458,500         82,999         4,6690         3,444,458,500           4000         84         8,0463         3,527,958,000         83,999         3,7610         3,527,958,000           5000         85         8,0393         3,612,457,500         84,999         3,9800         3,612,457,500           6000         86         8,4709         3,637,957,000         85,999         3,980         3,637,957,000           8000         88         8,9404         3,871,956,000         87,999         3,980         3,871,956,000           8000         88         8,9404         3,871,956,000         87,999         3,980         3,871,956,000           8000         89         3,0901         3,960,455,500         89,999         3,9490         3,960,455,500           8000         99         3,2650         4,049,955,								
1000         81         7,2164         3,280,459,500         80,999         3,1500         3,280,459,500           2000         82         7,7298         3,361,950,000         81,999         4,6690         3,444,456,500         82,999         4,6690         3,444,456,500         3,999         3,7610         3,527,958,000         3,999         3,7610         3,527,958,000         3,999         3,7610         3,527,958,000         3,999         3,7610         3,527,958,000         3,999         3,9690         3,612,457,500         6000         86         8,4709         3,637,957,000         85,999         3,9980         3,637,957,000         3,999         4,0010         3,784,456,500         3,999         4,0010         3,784,456,500         3,999         4,0010         3,784,456,500         3,999         4,0010         3,784,456,500         3,980         3,871,956,000         3,980         3,871,956,000         3,999         4,0010         3,784,456,500         3,999         4,0590         3,980         3,871,956,000         3,999         4,0590         3,980         3,871,956,000         3,999         4,0590         3,980         3,871,956,000         3,999         4,0590         3,980         3,871,956,000         3,999         4,0590         4,049,955,000         4,049,955,000								
2000         92         7,7298         3,361,959,000         81,999         3,3510         3,361,959,000           3000         83         7,5885         3,444,458,500         82,999         4,6690         3,444,458,500           4000         84         8,0463         3,527,958,000         83,999         3,7610         3,527,958,000           5000         85         8,0933         3,612,457,500         84,999         3,9690         3,612,457,500           6000         86         8,4709         3,687,957,000         85,999         3,980         3,687,957,000           8000         88         8,9404         3,871,956,000         87,999         3,980         3,871,956,000           8000         89         9,0901         3,960,455,500         88,999         3,9490         3,960,455,500           8000         89         9,091         3,960,455,500         88,999         3,9490         3,960,455,500           8000         99         2,650         4,049,955,000         89,999         4,0530         4,049,955,500           8000         91         3,1241         4,140,454,500         30,999         4,9620         4,140,454,500           2000         92         3,3478         4,231,954,0								
3000 83 7,5885 3,444,458,500 82,999 4,6690 3,444,458,50 4000 84 8,0463 3,527,958,000 83,999 3,7610 3,527,958,00 5000 85 8,0933 3,612,457,500 84,999 3,9690 3,612,457,500 6000 86 8,4709 3,897,957,000 85,999 4,0010 3,784,456,50 8000 88 8,9404 3,871,956,000 87,999 3,9880 3,871,956,000 9000 89 9,0901 3,360,455,500 88,999 3,999 3,9490 3,960,455,50 9000 99 9,2650 4,043,955,000 83,999 4,0590 4,0590 4,049,955,00 1000 91 9,1241 4,140,454,500 90,999 4,9520 4,140,454,500 2000 92 9,3478 4,231,954,000 91,999 5,4480 4,231,954,000 2000 92 9,3478 4,231,954,000 91,999 5,4480 4,231,954,000 93 9,6941 4,324,455,500 32,999 4,7560 4,417,953,000 6000 94 9,7265 4,417,953,000 33,999 4,7560 4,417,953,000 95 10,3236 4,512,452,500 94,999 5,0690 4,526,500 4,476,500 4,477,953,000 96 10,5899 4,607,952,000 95,999 4,960 4,667,952,000 95,999 4,9560 4,677,952,000 97 10,4398 4,704,451,500 95,999 5,5670 4,801,951,000 9900 99 10,9649 4,904,50,500 98,999 5,5670 4,801,951,000								
4000         84         8,0463         3,527,958,000         83,999         3,7610         3,527,958,00           5000         85         8,0933         3,612,457,500         84,999         3,6690         3,637,957,000           6000         86         8,4709         3,637,957,000         85,999         3,9980         3,637,957,000           7000         87         8,6901         3,784,456,500         86,999         4,0010         3,784,456,50           8000         88         8,9404         3,871,956,000         87,999         3,9490         3,9490         3,960,455,500           9000         89         9,0901         3,960,455,500         88,999         4,0590         3,9490         3,960,455,500           9000         9         9,2650         4,049,955,000         83,999         4,0590         4,049,955,000         4,099,999         4,0590         4,049,955,000         4,099,999         4,9620         4,140,454,500         30,999         4,9620         4,140,454,500         30,999         4,9620         4,140,454,500         30,999         4,9620         4,140,454,50,00         31,999         5,4480         4,231,954,000         4,231,954,000         33,999         4,7560         4,417,953,000         33,999         4,7560								
5000         85         8,0933         3,612,457,500         84,999         3,9690         3,612,457,500           6000         86         8,4709         3,687,957,000         85,999         3,9880         3,637,957,00           8000         88         8,9404         3,871,956,000         87,999         4,0010         3,784,456,500           8000         89         9,9901         3,960,455,500         88,999         3,9490         3,960,455,500           9000         99         3,2650         4,049,955,000         89,999         4,0590         4,049,955,000           1000         91         3,1241         4,140,454,500         90,999         4,9620         4,140,454,500           2000         92         3,3478         4,231,954,000         91,999         5,4480         4,231,954,000           3000         93         3,6831         4,324,453,500         29,999         5,1950         4,224,453,500           4000         94         9,7265         4,417,953,000         33,999         4,7560         4,417,953,000           6000         95         10,3236         4,512,452,500         94,939         5,0690         4,512,452,500           6000         96         10,5839         4,607,								
6000         86         8,4703         3,697,957,000         85,999         3,9980         3,697,957,000           7000         87         8,6901         3,784,456,500         86,999         4,0010         3,784,456,500           8000         88         8,9404         3,871,956,000         87,999         3,9880         3,871,956,000           9000         89         9,0301         3,960,455,500         88,999         3,9490         3,960,455,500           9000         90         3,2650         4,043,955,000         83,939         4,0520         4,043,955,000           1000         91         3,1241         4,140,454,500         9,099         4,9620         4,140,454,500           2000         92         3,3478         4,231,954,000         91,993         5,4480         4,231,954,000           3000         93         3,6941         4,324,453,500         32,999         5,1950         4,324,453,500           4000         94         9,7265         4,417,953,000         33,999         4,7560         4,417,953,000           5000         95         10,3236         4,512,452,500         94,999         5,0690         4,512,452,500           6000         96         10,5899         4,607,								
7000         87         8,6901         3,784,456,500         86,999         4,0010         3,784,456,500           8000         88         8,9404         3,871,956,000         87,999         3,9880         3,871,956,000           9000         89         9,0901         3,960,455,500         88,999         3,9490         3,960,455,500           9000         90         9,2650         4,043,955,000         83,939         4,0590         4,0590         4,043,955,000           9000         91         9,1241         4,140,454,500         90,993         4,9620         4,140,454,500           9000         92         9,3478         4,231,954,000         91,939         5,4480         4,231,954,000           9000         93         9,6841         4,324,453,500         92,939         5,1950         4,324,453,500           9000         94         9,7265         4,417,953,000         33,939         4,7560         4,417,953,000           9000         95         10,3236         4,512,452,500         94,939         5,0690         4,512,452,500           9000         96         10,5893         4,607,952,000         95,939         4,9260         4,607,952,000           9000         97         10,43								
8800         88         8,9404         3,871,956,000         87,999         3,9880         3,871,956,000           9000         89         9,9901         3,960,455,500         88,999         3,9490         3,960,455,500           9000         90         3,2650         4,043,955,000         89,999         4,0590         4,043,955,001           1000         91         3,1241         4,140,454,500         30,999         4,9620         4,140,454,500           2000         92         9,3478         4,231,954,000         91,999         5,4480         4,231,954,000           3000         93         3,6841         4,324,453,500         22,999         5,1950         4,324,453,500           4000         94         9,7265         4,417,953,000         33,999         4,7560         4,417,953,000           5000         95         10,3236         4,512,452,500         34,999         5,6890         4,512,452,500           6000         96         10,5899         4,607,952,000         95,999         4,9260         4,607,952,000           7000         97         10,4338         4,704,451,500         36,999         4,595         4,704,451,500           8000         98         10,9155         4,80								
9900 89 9,0901 3,960.455,500 88,999 3,9430 3,960.455,500 0000 90 9,2650 4.049,955.000 89,999 4,0500 4.049,955.000 1000 91 9,1241 4.140.454,500 90,999 4,9620 4.140,454,500 1000 92 9,3478 4.231,954,000 91,999 5,4480 4.231,954,000 1000 93 9,6941 4.324,453,500 32,999 5,1950 4.3560 4.477,953,000 1000 95 10,3236 4.512,452,500 94,999 5,0690 4.57560 4.477,953,000 1000 95 10,5899 4.607,952,000 94,999 5,0690 4.512,452,500 1000 96 10,5899 4.704,451,500 96,999 4,9550 4.704,451,500 1000 97 10,4398 4.704,451,500 96,999 4,5950 4,5950 4,704,451,500 1000 99 10,9649 4.904,50,500 97,999 5,5670 4,801,951,000 100 100 11,1151 4,999,950,000 99,999 5,3570 4,994,950,000								
0000         90         9,2650         4.049.955.000         89.999         4,0590         4.049.955.000           1000         91         9,1241         4.140.454.500         90.999         4,9620         4.140.454.500           2000         92         9,3478         4.231.954.000         91.999         5,1480         4.231.954.000           3000         93         9,6941         4.224.453.500         92.999         5,1950         4.324.453.500           4000         94         9,7265         4.417.953.000         93.999         4,7560         4.417.953.000           5000         95         10,3236         4.512.452.500         94.993         5,0690         4.512.452.500           6000         96         10,5899         4.607.952.000         95.999         4,9260         4.607.952.000           7000         97         10,4398         4.704.451.500         96.999         4,5950         4.704.451.500           8000         98         10,9155         4.801.951.000         97.999         5,5670         4.801.951.000           9000         99         10,9643         4.904.450.500         38.999         4,940         4.904.450.500           9000         10         11,1151         4.								
1000         91         9,1241         4,140,454,500         90,999         4,9620         4,140,454,500           2000         92         9,3478         4,231,954,000         91,999         5,4480         4,231,954,000           3000         93         9,6341         4,324,453,500         22,939         5,1950         4,324,453,500           4000         94         9,7265         4,417,953,000         33,999         4,7560         4,417,953,000           5000         95         10,3236         4,512,452,500         94,999         5,6690         4,512,452,500           6000         96         10,5839         4,607,952,000         95,999         4,9260         4,607,952,000           7000         97         10,4338         4,704,451,500         36,999         4,5950         4,704,451,500           8000         98         10,9155         4,801,951,000         97,999         5,5670         4,801,951,000           9000         99         10,9643         4,800,450,500         98,999         4,9440         4,900,450,500           9000         10         11,1151         4,999,950,000         99,999         5,5570         4,999,950,000								
22000         92         9,3478         4,231,954,000         91,999         5,4480         4,231,954,000           3000         93         9,6841         4,324,453,500         92,999         5,1950         4,324,453,50           4000         94         9,7265         4,417,953,000         39,999         4,7560         4,417,953,000           5000         95         10,3236         4,512,452,500         94,939         5,0690         4,512,452,50           6000         96         10,5893         4,607,952,000         95,993         4,9260         4,607,952,00           7000         97         10,4398         4,704,451,500         36,999         4,5950         4,704,451,500           8000         98         10,9155         4,801,951,000         97,999         5,5670         4,801,951,000           99000         99         10,9643         4,900,450,500         98,999         5,3570         4,999,950,000           9000         100         11,1151         4,999,950,000         99,999         5,3570         4,999,950,000			-					
33000   93   3,6941   4,324,453.500   92,999   5,1950   4,324,453.500   4,000   94   9,7265   4,417,953.000   93,999   4,7560   4,417,953.000   95,103.236   4,512,452.500   94,999   5,0690   4,512,452.500   6000   96   10,5899   4,607,952.000   95,999   4,9260   4,607,952.000   7,7000   97   10,4398   4,704,451.500   96,999   4,5950   4,704,451.500   8000   98   10,9155   4,801,951.000   97,999   5,5670   4,801,951.000   99000   99   10,9649   4,900,450.500   98,999   4,9440   4,900,450.500   99000   10,1151   4,999,950.000   99,399   5,3570   4,939,950.000   10,0000   100   11,1151   4,999,950.000   99,399   5,3570   4,939,950.000   1,939,950   1,939,950.000   1,939,950.000   1,939,950   1,		91						
94000 94 9,7265 4.417.953.000 93.999 4,7560 4.417.953.000 95.003236 4.512.452.500 94.999 5,0690 4.512.452.500 96.099 4,2660 4.607.952.000 95.00338 4,704.451.500 96.999 4,5950 4.704.451.500 98.009 98 10,9155 4.801.951.000 97.999 5,5670 4.801.951.000 99.003649 4.904.450.500 98.999 4,9440 4.904.450.500 99.0000 100 11,1151 4.999.950.000 99.99.999 5,3570 4.999.950.000	2000	92		4.231.954.000				
95000         95         10,3236         4,512,452,500         94,999         5,0690         4,512,452,500           96000         96         10,5893         4,607,952,000         95,993         4,3260         4,607,352,00           97000         97         10,4398         4,704,451,500         96,999         4,5950         4,704,451,500           88000         98         10,3155         4,801,951,000         97,999         5,5670         4,801,951,000           99000         99         10,9643         4,900,450,500         98,999         4,9440         4,900,450,500           00000         100         111,1151         4,999,950,000         99,999         5,3570         4,999,950,000	93000	93	9,6941	4.324.453.500	92.999			4.324.453.50
66000         96         10,5899         4,607.952.000         95.999         4,9260         4,607.952.00           17000         97         10,4338         4,704.451.500         96.939         4,5950         4,704.451.50           18000         98         10,9155         4,801.951.000         97.999         5,5670         4,801.951.000           19000         99         10,9649         4,900.450.500         98.939         4,9440         4,900.450.500           10000         100         11,1151         4,999.950.000         99.999         5,3570         4,999.950.00	4000	94	9,7265	4.417.953.000	93.999		4,7560	4.417.953.00
97         10,4338         4,704.451.500         96.999         4,5950         4,704.451.50           88000         98         10,9155         4,801.951.000         97.999         5,5670         4,801.951.00           99         10,9649         4,904.450.500         98.999         4,9440         4,904.450.50           00000         100         11,1151         4,999.950.000         99.999         5,3570         4,999.950.00	5000	95	10,3236	4.512.452.500	94.999		5,0690	4.512.452.50
8000     98     10,9155     4.801.951.000     97.999     5,5670     4.801.951.000       9900     99     10,9649     4.900.450.500     98.999     4,9440     4.900.450.50       00000     100     11,1151     4.999.950.000     99.999     5,3570     4.999.950.00	6000	96	10,5899	4.607.952.000	95.999		4,9260	4.607.952.00
9900 99 10,9649 4.900.450.500 98.999 4,9440 4.900.450.50 99000 100 11,1151 4.999.950.000 99.999 5,3570 4.999.950.000	7000	97	10,4398	4.704.451.500	96.999		4,5950	4.704.451.500
00000 100 11,1151 4.999.950.000 99.999 5,3570 4.999.950.000	98000	98	10,9155	4.801.951.000	97.999		5,5670	4.801.951.000
	99000	99	10,9649	4.900.450.500	98.999		4,9440	4.900.450.500
	00000	100	11,1151	4.999.950.000	99.999		5,3570	4.999.950.000
		MÉDIA						

Novamente C++ se sobressai a GO com 1,97 segundos a menos baseado na media. C++ mantém seus valores de tempo de forma equilibrada constante sem picos notórios de aumento ou baixas de tempo enquanto GO a partir do registro 60.000 possui aproximadamente o dobro dos valores de tempo para os testes subsequentes.

# **Gráficos Representativos:**

**BubbleSort: Go** x C++

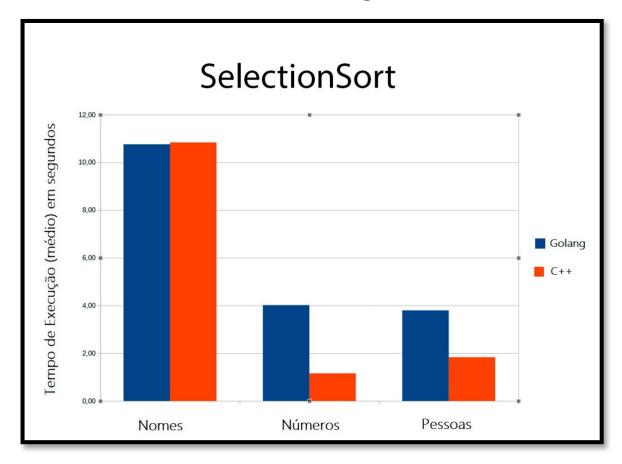


Golang possui maior vantagem na ordenação de números e números+strings em relação a C++.

C++ possui pequena vantagem na ordenação de números apenas em relação a Golang.

**Placar final:** Baseado nos gráficos, nos valores das tabelas comparativas e nas médias de tempo final, BubbleSort em Golang demonstra superioridade em relao a C++.

**SelectionSort:** Golang x C++

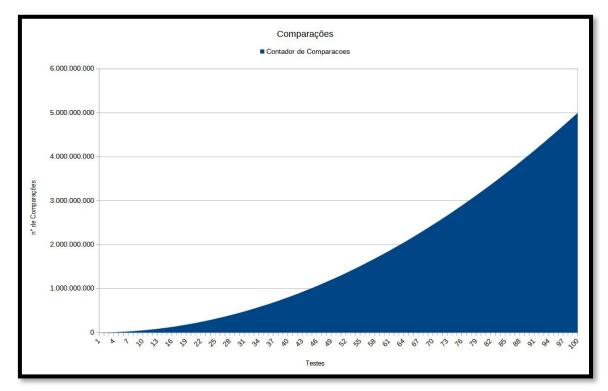


C++ possui vantagem na ordenação de números e números+strings em relação a Golang.

Golang possui pequena vantagem na ordenação de strings em relação a C++.

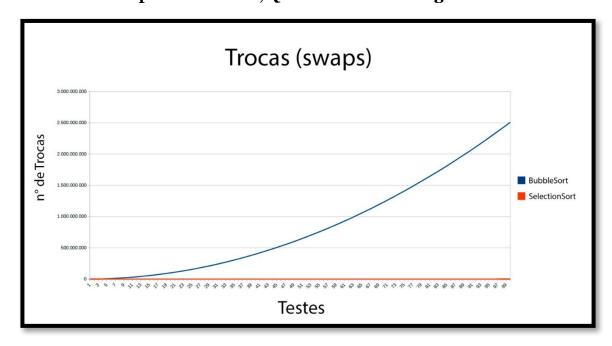
**Placar Final:** Baseado no nos gráficos, tabelas e médias finais, C++ possui vantagem na implementação do SelectionSort em relação a Golang.

### Comparações: BubbleSort, QuickSort em Golang e C++



O número de comparações é equivalente para ambos os algoritmos de ordenação implementados em ambas as linguagens.

Swaps: Bubblesort, QuickSort em Golang e C++



Nota-se uma queda drástica de trocas realizadas pelo algoritmo de Selectionsort, já que essa ação é bastante otimizada para ele em comparação com o Bubblesort.

### Conclusões sobre as implementações:

# 1. Qual a melhor implementação de cada algoritmo (C++/Go) para cada tipo de dados?

**BubbleSort:** Analisando os gráficos, tabelas e médias finais Golang apresenta maior vantagem em relação a C++ na ordenação de strings. Enquanto nos valores numéricos a diferença da vantagem do C++ é mínima sendo ambos quase equivalentes. Desse modo BubbleSort em Golang demonstra superioridade geral em sua implementação em relação a C++.

**SelectionSort:** Analisando os gráficos, tabelas e medias finais C++ notoriamente possui vantagem em relação a Golang principalmente na ordenação numérica. Golang possui uma vantagem mínima, quase equivalente a C++, em relação a ordenação de strings. Por tanto os menores tempos apresentados para a realização da ordenação pela maior quantidade de trocas e comparações , SelectionSort em C++ demonstra superioridade geral em sua implementação em relação a C++.

# 2. Qual o melhor algoritmo para cada tipo de dados, considerando apenas uma das linguagens?

SelectionSort em C++ é claramente superior em relação ao BubbleSort tanto em Go quanto em C++, possuindo menos trocas (encontramos que SelectionSort possui aproximadamente 99,994024% menos trocas do que BubbleSort. Isso significa que SelectionSort representa apenas cerca de 0,006% das trocas em relação a BubbleSort) e menores tempos de execução (68,13% a menos de tempo baseado nas médias).

# 3. Qual algoritmo foi melhor para cada tipo de dados, independente da linguagem de implementação?

SelectionSort foi melhor para todos os tipo de dados em relação ao BubbleSort independente da linguagem de programação. SelectionSort é superior em trocas e tempos de execução.

# 4. Qual linguagem apresentou melhor desempenho geral, independente do algoritmo implementado?

Considerando as medias dos tempos de execução houve um empate entre as linguagens, Go se sobressaiu em 3 testes (2 BubbleSort (12,34 e 23,96) e 1 SelectionSort (10,76)) e C++ (2 SelectionSort (1,15 e 1,83) e 1 BubbleSort (5,97)) também se sobressaiu em 3 testes.

Considerando a linguagem que possui os melhores resultados dos 3 testes em que se sobressaíram, o melhor desempenho geral fica com C++.

# 5. Qual algoritmo apresentou melhor desempenho geral, independente da linguagem de implementação?

SelectionSort possui as melhores médias de tempo (Soma das Médias: 34,40) em relação a BubbleSort (Soma das Médias: 97,84) além do baixo número de trocas.