

# Relatório da Lista 01

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## 1. Implementação, Estratégia e Desafios

Este trabalho tem como objetivos:

1. Implementar os algoritmos *BFS-Graph*, *Iterative Deepening*, *A\**, *IDA\** e *Greedy Best-First Search* para o problema do 8-puzzle.
2. Implementar o algoritmo *A\** para o problema do 15-puzzle.

Para a implementação dos algoritmos de busca, utilizou-se a linguagem C++ junto com a biblioteca *STL* para estruturas de dados. Os nós foram representados por meio de uma *struct*, enquanto o estado de cada nó foi modelado utilizando um *vector<int>*. Especificamente, os algoritmos de busca heurística empregaram a distância de Manhattan como função heurística. As seguintes características principais merecem destaque por estabelecerem desafios:

1. Não é necessário contabilizar o espaço vazio (blank) para o cálculo da distância heurística.
2. Foi implementada uma verificação nos nós que evita a expansão caso o estado atual seja igual ao estado do nó pai.
3. Para resolver empates em que os valores da heurística e do custo são iguais, foi adotada a estratégia *LIFO* (Last In, First Out).

## 2. Resumo dos resultados

A partir do conjunto de dados de entrada, a Tabela 1, exibe, para cada um dos algoritmos de interesse, os valores médios de: nodos expandidos, comprimento da solução ótima, tempo para solução, valor médio da função heurística, valor da função heurística no estado inicial.

Alg	N. Expandidos	C. da S. Ótima	T. para Solução (s)	Média da H.	H. no E. Inicial
BFS	81459.54	22.16	0.10584256	0	13.88
IDFS	2578290.56	22.16	0.683926897	0	13.88
GBFS	362.36	134.42	0.00036844	6.9613301	13.88
A*	895	22.16	0.0009131	10.0406493	13.88
IDA*	2373.03	22.16	0.00121986	10.399337	13.88

Table 1. Médias dos valores

Para o algoritmo do A\* aplicado ao conjunto de entradas do 15-puzzle foram obtidas soluções para **66** estados iniciais.

### 3. Resultados

#### 3.1. Resultados para o BFS

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
5 6 2 7 1 8 3 4 0	70436	22	0.078395	0	12
5 3 2 8 7 1 4 0 6	98412	23	0.093223	0	15
1 0 7 5 2 4 3 8 6	11718	17	0.00993	0	13
3 6 4 2 8 0 5 7 1	134664	25	0.141162	0	17
0 6 1 7 4 2 3 8 5	5209	16	0.003595	0	10
0 3 8 2 1 4 7 6 5	59830	22	0.080083	0	12
0 8 2 1 5 6 7 3 4	71614	22	0.088727	0	14
5 0 2 6 4 8 1 7 3	42704	21	0.051381	0	11
3 0 8 4 1 2 6 7 5	10486	17	0.010394	0	7
7 2 6 3 1 5 8 0 4	55230	21	0.065752	0	13
2 4 7 0 3 6 8 1 5	86288	23	0.108071	0	15
2 1 6 0 4 3 7 5 8	87902	23	0.105363	0	11
1 2 8 0 3 7 5 6 4	24271	19	0.023418	0	13
1 4 8 2 7 6 0 3 5	67445	22	0.088397	0	14
5 0 2 1 6 8 7 3 4	21294	19	0.0194	0	13
6 2 1 5 0 4 3 8 7	67976	22	0.093427	0	10
1 8 0 4 5 2 6 7 3	30932	20	0.041732	0	10
7 6 4 8 1 3 5 0 2	51926	21	0.063127	0	19
1 8 7 5 0 4 2 3 6	74010	22	0.096534	0	18
2 8 0 4 1 7 5 6 3	57200	22	0.062946	0	16
7 8 1 3 6 2 4 5 0	6175	16	0.006067	0	14
1 4 7 3 6 2 0 8 5	4890	16	0.005469	0	10
5 2 3 4 7 1 8 0 6	128087	25	0.145827	0	15
5 1 3 2 6 4 7 8 0	59140	22	0.067203	0	14
1 0 2 5 8 6 4 7 3	86044	23	0.111605	0	13
4 7 6 0 5 2 3 8 1	124428	25	0.150492	0	15
5 8 2 1 7 6 3 0 4	55828	21	0.076226	0	15
3 0 2 6 1 4 5 7 8	1904	13	0.001352	0	7
2 0 1 7 5 3 8 6 4	89286	23	0.110296	0	13
8 1 0 5 3 7 2 4 6	96167	24	0.122508	0	16
0 2 6 5 4 7 1 3 8	108997	24	0.130991	0	14
4 5 0 1 7 2 3 8 6	6800	16	0.005849	0	12
0 6 3 5 8 2 1 7 4	12237	18	0.013149	0	16
1 4 8 0 7 5 2 6 3	91221	23	0.122894	0	13
1 5 0 8 4 3 2 7 6	146642	26	0.177451	0	14
2 3 6 8 1 0 5 4 7	166169	27	0.216479	0	17
1 6 0 7 3 8 4 5 2	61999	22	0.076181	0	14
8 4 3 1 6 5 0 7 2	149038	26	0.194647	0	14
3 8 2 7 5 1 0 6 4	66394	22	0.086631	0	12
7 2 3 6 4 8 1 0 5	134964	25	0.173046	0	13

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
3 1 2 4 0 8 5 7 6	3528	14	0.002485	0	8
8 5 3 1 2 6 4 0 7	141058	25	0.186196	0	19
2 0 8 6 1 3 4 7 5	51334	21	0.071283	0	11
3 6 7 1 2 8 4 5 0	147235	26	0.179957	0	16
0 3 6 1 2 8 4 7 5	96629	24	0.132276	0	14
4 8 6 5 0 7 1 3 2	117820	24	0.155287	0	20
7 2 0 1 8 6 3 4 5	12721	18	0.010701	0	14
4 0 7 1 3 2 5 8 6	82402	23	0.111977	0	15
1 4 3 0 5 8 7 6 2	55950	21	0.082173	0	11
1 3 6 5 8 4 0 2 7	170358	28	0.21196	0	16
3 1 6 4 0 8 7 5 2	41346	20	0.058866	0	12
8 0 5 1 4 3 7 2 6	163708	27	0.225535	0	15
1 0 2 8 7 3 4 6 5	25948	19	0.022785	0	11
5 8 1 4 7 3 2 6 0	146431	26	0.189662	0	16
6 4 1 2 0 3 7 8 5	16644	18	0.015434	0	12
6 1 7 4 8 3 5 2 0	113398	24	0.165257	0	16
0 1 5 3 8 7 6 4 2	12763	18	0.009956	0	8
7 8 2 6 4 3 0 1 5	102477	24	0.148729	0	12
6 0 8 7 4 3 5 2 1	91593	23	0.127182	0	17
5 4 0 7 6 2 8 3 1	116022	24	0.155713	0	16
5 6 1 8 7 0 2 4 3	170975	27	0.221269	0	19
1 6 7 4 2 0 3 5 8	132375	25	0.180609	0	13
5 3 6 4 7 2 1 0 8	43631	21	0.053399	0	15
0 8 7 4 2 6 1 3 5	61343	22	0.087101	0	18
7 2 0 5 4 3 8 6 1	173107	28	0.223071	0	14
5 3 0 6 7 1 8 2 4	37323	20	0.048419	0	16
5 7 2 8 3 6 4 0 1	166627	27	0.232662	0	17
3 7 8 1 4 6 5 0 2	165544	27	0.224125	0	15
7 4 5 8 6 3 2 0 1	136365	25	0.192649	0	19
0 4 1 8 2 5 3 7 6	101428	24	0.145655	0	10
5 1 7 2 3 6 8 4 0	99337	24	0.135712	0	16
6 3 4 8 2 1 5 7 0	69657	22	0.103049	0	16
2 0 1 5 7 6 4 8 3	169153	27	0.213128	0	15
7 8 0 6 3 1 2 5 4	146614	26	0.189997	0	18
6 2 4 3 7 0 5 1 8	136769	25	0.183887	0	11
7 5 4 8 3 6 0 2 1	144168	26	0.195641	0	20
3 8 4 5 7 1 0 6 2	32178	20	0.037022	0	14
5 6 2 8 7 1 0 3 4	149505	26	0.195262	0	16
3 2 4 6 5 8 0 7 1	6810	16	0.004888	0	10
7 5 1 6 8 4 2 0 3	165286	27	0.225994	0	17
3 5 2 0 8 1 4 6 7	20088	19	0.020008	0	11
8 0 6 7 1 3 5 2 4	134133	25	0.19683	0	21
2 5 8 4 1 0 6 3 7	3471	15	0.002251	0	11
7 0 2 1 8 6 3 4 5	9452	17	0.007741	0	13

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
2 1 5 3 8 0 6 7 4	4001	15	0.003217	0	7
3 8 6 4 7 0 1 5 2	134421	25	0.192317	0	17
1 0 7 2 4 3 6 8 5	10951	17	0.009451	0	11
3 6 7 5 8 0 4 1 2	165164	27	0.236043	0	17
6 2 0 3 1 4 8 7 5	32194	20	0.051673	0	8
7 1 5 4 0 3 2 6 8	37083	20	0.064553	0	12
8 0 7 4 6 1 5 2 3	163614	27	0.218943	0	21
8 2 0 5 7 6 1 3 4	145000	26	0.190335	0	18
3 8 5 7 0 1 6 4 2	68791	22	0.087706	0	12
3 5 4 1 7 6 0 2 8	69185	22	0.101304	0	14
0 2 8 5 4 1 7 3 6	66051	22	0.098993	0	12
4 3 7 0 6 1 5 8 2	25603	19	0.026716	0	17
2 1 3 4 6 5 0 7 8	30499	20	0.04552	0	8
1 0 5 4 6 2 7 3 8	45472	21	0.064055	0	9
7 2 3 1 5 4 8 6 0	106698	24	0.126677	0	14
5 7 2 6 4 0 8 3 1	130566	25	0.16355	0	13

### 3.2. Resultados para o IDFS

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
5 6 2 7 1 8 3 4 0	809224	22	0.230855	0	12
5 3 2 8 7 1 4 0 6	1659716	23	0.456155	0	15
1 0 7 5 2 4 3 8 6	56332	17	1.60E-02	0	13
3 6 4 2 8 0 5 7 1	3832745	25	1.10637	0	17
0 6 1 7 4 2 3 8 5	20305	16	6.13E-03	0	10
0 3 8 2 1 4 7 6 5	572929	22	0.166784	0	12
0 8 2 1 5 6 7 3 4	840836	22	0.241276	0	14
5 0 2 6 4 8 1 7 3	336804	21	9.72E-02	0	11
3 0 8 4 1 2 6 7 5	48030	17	0.0153972	0	7
7 2 6 3 1 5 8 0 4	523656	21	0.154203	0	13
2 4 7 0 3 6 8 1 5	1183127	23	3.35E-01	0	15
2 1 6 0 4 3 7 5 8	1229083	23	0.343191	0	11
1 2 8 0 3 7 5 6 4	144153	19	4.07E-02	0	13
1 4 8 2 7 6 0 3 5	726908	22	0.199644	0	14
5 0 2 1 6 8 7 3 4	119854	19	3.44E-02	0	13
6 2 1 5 0 4 3 8 7	746437	22	0.218171	0	10
1 8 0 4 5 2 6 7 3	201422	20	5.46E-02	0	10
7 6 4 8 1 3 5 0 2	463439	21	1.26E-01	0	19
1 8 7 5 0 4 2 3 6	880730	22	0.264854	0	18

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
2 8 0 4 1 7 5 6 3	529433	22	0.164951	0	16
7 8 1 3 6 2 4 5 0	25389	16	7.69E-03	0	14
1 4 7 3 6 2 0 8 5	18803	16	5.65E-03	0	10
5 2 3 4 7 1 8 0 6	3233556	25	0.937183	0	15
5 1 3 2 6 4 7 8 0	559966	22	0.150457	0	14
1 0 2 5 8 6 4 7 3	1161412	23	0.310092	0	13
4 7 6 0 5 2 3 8 1	3012022	25	0.796673	0	15
5 8 2 1 7 6 3 0 4	533665	21	0.143398	0	15
3 0 2 6 1 4 5 7 8	6472	13	1.82E-03	0	7
2 0 1 7 5 3 8 6 4	1258485	23	0.336656	0	13
8 1 0 5 3 7 2 4 6	1506581	24	0.395591	0	16
0 2 6 5 4 7 1 3 8	2082556	24	0.563789	0	14
4 5 0 1 7 2 3 8 6	28816	16	8.09E-03	0	12
0 6 3 5 8 2 1 7 4	57963	18	1.53E-02	0	16
1 4 8 0 7 5 2 6 3	1339032	23	0.425032	0	13
1 5 0 8 4 3 2 7 6	5227219	26	1.4337	0	14
2 3 6 8 1 0 5 4 7	10582097	27	2.80396	0	17
1 6 0 7 3 8 4 5 2	618550	22	0.160686	0	14
8 4 3 1 6 5 0 7 2	5647709	26	1.45583	0	14
3 8 2 7 5 1 0 6 4	707091	22	0.19354	0	12
7 2 3 6 4 8 1 0 5	3906491	25	1.01349	0	13
3 1 2 4 0 8 5 7 6	13166	14	3.58E-03	0	8
8 5 3 1 2 6 4 0 7	4826279	25	1.29E+00	0	19
2 0 8 6 1 3 4 7 5	445186	21	0.11853	0	11
3 6 7 1 2 8 4 5 0	5301125	26	1.39299	0	16
0 3 6 1 2 8 4 7 5	1521264	24	0.395669	0	14
4 8 6 5 0 7 1 3 2	2550556	24	0.665272	0	20
7 2 0 1 8 6 3 4 5	60744	18	1.58E-02	0	14
4 0 7 1 3 2 5 8 6	1071876	23	0.276385	0	15
1 4 3 0 5 8 7 6 2	542261	21	0.141593	0	11
1 3 6 5 8 4 0 2 7	13426501	28	3.49622	0	16
3 1 6 4 0 8 7 5 2	323493	20	0.086167	0	12
8 0 5 1 4 3 7 2 6	9617303	27	2.54E+00	0	15
1 0 2 8 7 3 4 6 5	160297	19	0.0429823	0	11
5 8 1 4 7 3 2 6 0	5150682	26	1.35823	0	16
6 4 1 2 0 3 7 8 5	86884	18	0.0225814	0	12
6 1 7 4 8 3 5 2 0	2296791	24	5.98E-01	0	16
0 1 5 3 8 7 6 4 2	60654	18	0.0157843	0	8
7 8 2 6 4 3 0 1 5	1715624	24	0.440831	0	12
6 0 8 7 4 3 5 2 1	1336827	23	3.44E-01	0	17
5 4 0 7 6 2 8 3 1	2536222	24	6.60E-01	0	16
5 6 1 8 7 0 2 4 3	15171649	27	3.94918	0	19
1 6 7 4 2 0 3 5 8	3587527	25	0.952608	0	13
5 3 6 4 7 2 1 0 8	344582	21	0.0910115	0	15

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
0 8 7 4 2 6 1 3 5	599226	22	1.59E-01	0	18
7 2 0 5 4 3 8 6 1	15073854	28	3.9634	0	14
5 3 0 6 7 1 8 2 4	277227	20	7.29E-02	0	16
5 7 2 8 3 6 4 0 1	10843669	27	3.03024	0	17
3 7 8 1 4 6 5 0 2	10295974	27	2.66367	0	15
7 4 5 8 6 3 2 0 1	4095213	25	1.06E+00	0	19
0 4 1 8 2 5 3 7 6	1665813	24	0.43482	0	10
5 1 7 2 3 6 8 4 0	1583030	24	0.409869	0	16
6 3 4 8 2 1 5 7 0	792904	22	0.211528	0	16
2 0 1 5 7 6 4 8 3	12496979	27	3.26928	0	15
7 8 0 6 3 1 2 5 4	5225955	26	1.34957	0	18
6 2 4 3 7 0 5 1 8	4088312	25	1.06165	0	11
7 5 4 8 3 6 0 2 1	4873453	26	1.27789	0	20
3 8 4 5 7 1 0 6 2	214527	20	0.0571427	0	14
5 6 2 8 7 1 0 3 4	5735592	26	1.51574	0	16
3 2 4 6 5 8 0 7 1	28881	16	7.82E-03	0	10
7 5 1 6 8 4 2 0 3	10128430	27	2.66876	0	17
3 5 2 0 8 1 4 6 7	110829	19	0.0297508	0	11
8 0 6 7 1 3 5 2 4	3745531	25	0.995021	0	21
2 5 8 4 1 0 6 3 7	12608	15	3.47E-03	0	11
7 0 2 1 8 6 3 4 5	42323	17	1.13E-02	0	13
2 1 5 3 8 0 6 7 4	15054	15	4.09E-03	0	7
3 8 6 4 7 0 1 5 2	3814064	25	1.00992	0	17
1 0 7 2 4 3 6 8 5	51080	17	1.37E-02	0	11
3 6 7 5 8 0 4 1 2	10083429	27	2.6501	0	17
6 2 0 3 1 4 8 7 5	216000	20	0.0572051	0	8
7 1 5 4 0 3 2 6 8	269408	20	0.0710215	0	12
8 0 7 4 6 1 5 2 3	9608157	27	2.51625	0	21
8 2 0 5 7 6 1 3 4	4963354	26	1.30229	0	18
3 8 5 7 0 1 6 4 2	761900	22	0.200989	0	12
3 5 4 1 7 6 0 2 8	779904	22	0.206915	0	14
0 2 8 5 4 1 7 3 6	713444	22	0.189298	0	12
4 3 7 0 6 1 5 8 2	156601	19	0.0416026	0	17
2 1 3 4 6 5 0 7 8	197513	20	0.0522408	0	8
1 0 5 4 6 2 7 3 8	365116	21	9.61E-02	0	9
7 2 3 1 5 4 8 6 0	1905883	24	0.503089	0	14
5 7 2 6 4 0 8 3 1	3411288	25	0.895268	0	13

### 3.3. Resultados para o GBFS

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
5 6 2 7 1 8 3 4 0	554	164	0.000857	6.91591	12
5 3 2 8 7 1 4 0 6	393	187	0.000455	6.8592	15
1 0 7 5 2 4 3 8 6	421	189	0.000446	6.60133	13
3 6 4 2 8 0 5 7 1	443	207	0.000479	6.91508	17
0 6 1 7 4 2 3 8 5	16	16	1.70E-05	5.87097	10
0 3 8 2 1 4 7 6 5	366	152	0.000392	6.5425	12
0 8 2 1 5 6 7 3 4	384	168	0.000409	6.58407	14
5 0 2 6 4 8 1 7 3	96	27	9.40E-05	8.08982	11
3 0 8 4 1 2 6 7 5	569	87	0.000634	6.7313	7
7 2 6 3 1 5 8 0 4	632	119	0.000707	7.04911	13
2 4 7 0 3 6 8 1 5	90	57	9.00E-05	6.84756	15
2 1 6 0 4 3 7 5 8	171	77	0.000165	8.07667	11
1 2 8 0 3 7 5 6 4	84	51	9.50E-05	5.93289	13
1 4 8 2 7 6 0 3 5	496	146	0.000542	6.74095	14
5 0 2 1 6 8 7 3 4	66	39	6.50E-05	6.2	13
6 2 1 5 0 4 3 8 7	495	146	0.00054	6.7096	10
1 8 0 4 5 2 6 7 3	77	44	7.40E-05	6.42647	10
7 6 4 8 1 3 5 0 2	46	37	4.40E-05	7.89412	19
1 8 7 5 0 4 2 3 6	385	160	0.000422	6.8207	18
2 8 0 4 1 7 5 6 3	428	190	0.000457	6.81987	16
7 8 1 3 6 2 4 5 0	538	132	0.00056	6.77894	14
1 4 7 3 6 2 0 8 5	412	166	0.000419	6.61157	10
5 2 3 4 7 1 8 0 6	114	71	0.000103	7.51456	15
5 1 3 2 6 4 7 8 0	452	174	0.000463	7.00126	14
1 0 2 5 8 6 4 7 3	400	189	0.000417	6.63636	13
4 7 6 0 5 2 3 8 1	426	187	0.000443	6.89467	15
5 8 2 1 7 6 3 0 4	445	203	0.000461	6.82197	15
3 0 2 6 1 4 5 7 8	17	15	1.70E-05	5.65714	7
2 0 1 7 5 3 8 6 4	403	165	0.000426	6.69091	13
8 1 0 5 3 7 2 4 6	537	140	0.000559	6.96339	16
0 2 6 5 4 7 1 3 8	128	38	0.000112	8.68037	14
4 5 0 1 7 2 3 8 6	63	34	5.50E-05	7.86486	12
0 6 3 5 8 2 1 7 4	452	194	0.000467	6.76559	16
1 4 8 0 7 5 2 6 3	430	195	0.00045	6.8419	13
1 5 0 8 4 3 2 7 6	516	162	0.00055	6.92484	14
2 3 6 8 1 0 5 4 7	111	79	0.000102	7.85859	17
1 6 0 7 3 8 4 5 2	583	98	0.000596	6.8415	14
8 4 3 1 6 5 0 7 2	546	148	0.000569	6.89928	14
3 8 2 7 5 1 0 6 4	403	184	0.000415	6.70547	12
7 2 3 6 4 8 1 0 5	452	211	0.000457	6.94987	13
3 1 2 4 0 8 5 7 6	350	140	0.000357	6.41224	8
8 5 3 1 2 6 4 0 7	65	45	5.60E-05	7.8	19
2 0 8 6 1 3 4 7 5	505	155	0.000508	6.74499	11
3 6 7 1 2 8 4 5 0	174	72	0.000145	7.38462	16

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
0 3 6 1 2 8 4 7 5	526	130	0.000533	6.89722	14
4 8 6 5 0 7 1 3 2	419	184	0.000441	6.97584	20
7 2 0 1 8 6 3 4 5	19	18	1.70E-05	7.81081	14
4 0 7 1 3 2 5 8 6	384	181	0.000396	6.77059	15
1 4 3 0 5 8 7 6 2	548	149	0.000566	6.84718	11
1 3 6 5 8 4 0 2 7	461	198	0.000471	7.30494	16
3 1 6 4 0 8 7 5 2	484	174	0.000478	7.03756	12
8 0 5 1 4 3 7 2 6	88	49	6.90E-05	7.56774	15
1 0 2 8 7 3 4 6 5	598	101	0.000586	6.79061	11
5 8 1 4 7 3 2 6 0	457	206	0.000436	7.33042	16
6 4 1 2 0 3 7 8 5	476	198	0.000474	6.99762	12
6 1 7 4 8 3 5 2 0	46	36	3.70E-05	7.36782	16
0 1 5 3 8 7 6 4 2	479	180	0.000472	6.95498	8
7 8 2 6 4 3 0 1 5	454	216	0.000447	7.0347	12
6 0 8 7 4 3 5 2 1	79	55	6.20E-05	7.79433	17
5 4 0 7 6 2 8 3 1	67	46	7.40E-05	6.71074	16
5 6 1 8 7 0 2 4 3	174	69	0.000194	7.48322	19
1 6 7 4 2 0 3 5 8	360	153	0.000357	6.56338	13
5 3 6 4 7 2 1 0 8	628	195	0.000602	7.23663	15
0 8 7 4 2 6 1 3 5	414	188	0.000411	6.95782	18
7 2 0 5 4 3 8 6 1	163	72	0.000131	9.79577	14
5 3 0 6 7 1 8 2 4	20	20	3.70E-05	8.08108	16
5 7 2 8 3 6 4 0 1	657	129	0.000628	7.12339	17
3 7 8 1 4 6 5 0 2	493	197	0.000464	6.99655	15
7 4 5 8 6 3 2 0 1	62	41	4.90E-05	7.69912	19
0 4 1 8 2 5 3 7 6	388	170	0.0004	6.54532	10
5 1 7 2 3 6 8 4 0	545	158	0.00055	6.98764	16
6 3 4 8 2 1 5 7 0	393	166	0.000402	6.63453	16
2 0 1 5 7 6 4 8 3	418	181	0.000395	6.91903	15
7 8 0 6 3 1 2 5 4	410	178	0.000408	6.71763	18
6 2 4 3 7 0 5 1 8	382	175	0.000382	6.53666	11
7 5 4 8 3 6 0 2 1	400	176	0.000386	6.83711	20
3 8 4 5 7 1 0 6 2	415	164	0.000399	6.58209	14
5 6 2 8 7 1 0 3 4	445	194	0.00044	6.89886	16
3 2 4 6 5 8 0 7 1	451	194	0.000437	6.62344	10
7 5 1 6 8 4 2 0 3	407	179	0.000389	6.79358	17
3 5 2 0 8 1 4 6 7	583	129	0.000568	6.83691	11
8 0 6 7 1 3 5 2 4	444	197	0.000436	6.99873	21
2 5 8 4 1 0 6 3 7	61	41	4.70E-05	5.74561	11
7 0 2 1 8 6 3 4 5	18	17	1.50E-05	7.36111	13
2 1 5 3 8 0 6 7 4	383	149	0.000393	6.43382	7
3 8 6 4 7 0 1 5 2	566	175	0.00054	7.083	17
1 0 7 2 4 3 6 8 5	418	179	0.00041	6.6626	11
3 6 7 5 8 0 4 1 2	594	175	0.000569	7.10322	17



<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
6 2 0 3 1 4 8 7 5	376	168	0.000395	6.3994	8
7 1 5 4 0 3 2 6 8	521	150	0.000498	6.74138	12
8 0 7 4 6 1 5 2 3	571	151	0.000566	7.09252	21
8 2 0 5 7 6 1 3 4	452	208	0.000436	6.92902	18
3 8 5 7 0 1 6 4 2	467	164	0.000463	6.94411	12
3 5 4 1 7 6 0 2 8	578	152	0.000586	6.99022	14
0 2 8 5 4 1 7 3 6	369	152	0.000342	6.69372	12
4 3 7 0 6 1 5 8 2	362	161	0.00037	6.60998	17
2 1 3 4 6 5 0 7 8	437	162	0.000423	6.86641	8
1 0 5 4 6 2 7 3 8	48	29	3.50E-05	5.74157	9
7 2 3 1 5 4 8 6 0	611	104	0.000606	6.95856	14
5 7 2 6 4 0 8 3 1	433	199	0.000435	6.86216	13

### 3.4. Resultados para o A\*

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
5 6 2 7 1 8 3 4 0	835	22	0.001155	9.08244	12
5 3 2 8 7 1 4 0 6	1024	23	0.001415	10.06785	15
1 0 7 5 2 4 3 8 6	72	17	9.20E-05	9.19685	13
3 6 4 2 8 0 5 7 1	953	25	0.00127	11.67916	17
0 6 1 7 4 2 3 8 5	91	16	1.18E-04	6.78788	10
0 3 8 2 1 4 7 6 5	652	22	0.000876	9.37239	12
0 8 2 1 5 6 7 3 4	350	22	0.000424	10.44218	14
5 0 2 6 4 8 1 7 3	612	21	7.83E-04	9.81538	11
3 0 8 4 1 2 6 7 5	232	17	0.000248	7.87032	7
7 2 6 3 1 5 8 0 4	177	21	0.000232	10.81419	13
2 4 7 0 3 6 8 1 5	511	23	6.50E-04	9.98009	15
2 1 6 0 4 3 7 5 8	1037	23	0.00129	10.38902	11
1 2 8 0 3 7 5 6 4	197	19	2.12E-04	8.39706	13
1 4 8 2 7 6 0 3 5	697	22	0.000868	9.28413	14
5 0 2 1 6 8 7 3 4	239	19	2.61E-04	7.92079	13
6 2 1 5 0 4 3 8 7	1622	22	0.001985	9.72711	10
1 8 0 4 5 2 6 7 3	315	20	3.05E-04	8.87546	10
7 6 4 8 1 3 5 0 2	30	21	2.90E-05	10.32076	19
1 8 7 5 0 4 2 3 6	373	22	0.000401	10.57532	18
2 8 0 4 1 7 5 6 3	550	22	0.000646	10.56108	16
7 8 1 3 6 2 4 5 0	34	16	3.40E-05	8.35484	14
1 4 7 3 6 2 0 8 5	118	16	0.000113	8.50244	10
5 2 3 4 7 1 8 0 6	1449	25	0.001775	10.86418	15

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
5 1 3 2 6 4 7 8 0	873	22	0.000993	10.08725	14
1 0 2 5 8 6 4 7 3	808	23	0.000929	9.78744	13
4 7 6 0 5 2 3 8 1	1167	25	0.001344	10.50693	15
5 8 2 1 7 6 3 0 4	308	21	0.000279	9.43536	15
3 0 2 6 1 4 5 7 8	41	13	3.90E-05	6.19737	7
2 0 1 7 5 3 8 6 4	533	23	0.000624	11.03255	13
8 1 0 5 3 7 2 4 6	346	24	0.000415	11.50257	16
0 2 6 5 4 7 1 3 8	929	24	0.001097	10.29217	14
4 5 0 1 7 2 3 8 6	117	16	1.06E-04	8.72549	12
0 6 3 5 8 2 1 7 4	26	18	2.40E-05	9.08163	16
1 4 8 0 7 5 2 6 3	666	23	0.000752	10.1413	13
1 5 0 8 4 3 2 7 6	1734	26	0.001908	10.78591	14
2 3 6 8 1 0 5 4 7	1824	27	0.001969	12.14219	17
1 6 0 7 3 8 4 5 2	231	22	0.000189	11.43264	14
8 4 3 1 6 5 0 7 2	1807	26	0.002066	10.70881	14
3 8 2 7 5 1 0 6 4	655	22	0.000541	9.45958	12
7 2 3 6 4 8 1 0 5	2298	25	0.002647	10.22482	13
3 1 2 4 0 8 5 7 6	76	14	6.30E-05	7.49265	8
8 5 3 1 2 6 4 0 7	786	25	6.07E-04	11.26708	19
2 0 8 6 1 3 4 7 5	609	21	0.000878	9.23767	11
3 6 7 1 2 8 4 5 0	2231	26	0.002477	10.65053	16
0 3 6 1 2 8 4 7 5	1757	24	0.001839	9.85346	14
4 8 6 5 0 7 1 3 2	299	24	0.000223	11.508	20
7 2 0 1 8 6 3 4 5	41	18	3.10E-05	10.09333	14
4 0 7 1 3 2 5 8 6	543	23	0.000641	10.69316	15
1 4 3 0 5 8 7 6 2	438	21	0.000607	10.06873	11
1 3 6 5 8 4 0 2 7	2864	28	0.002986	12.25565	16
3 1 6 4 0 8 7 5 2	221	20	0.000158	9.80103	12
8 0 5 1 4 3 7 2 6	2849	27	2.96E-03	11.07161	15
1 0 2 8 7 3 4 6 5	179	19	0.000122	8.8479	11
5 8 1 4 7 3 2 6 0	1075	26	0.000977	11.57954	16
6 4 1 2 0 3 7 8 5	177	18	0.000121	8.60518	12
6 1 7 4 8 3 5 2 0	752	24	9.57E-04	10.09321	16
0 1 5 3 8 7 6 4 2	182	18	0.000125	8.21154	8
7 8 2 6 4 3 0 1 5	1355	24	0.001636	10.0844	12
6 0 8 7 4 3 5 2 1	205	23	1.41E-04	11.06304	17
5 4 0 7 6 2 8 3 1	712	24	7.93E-04	10.59117	16
5 6 1 8 7 0 2 4 3	1421	27	0.001579	12.0245	19
1 6 7 4 2 0 3 5 8	2186	25	0.002327	9.9186	13
5 3 6 4 7 2 1 0 8	168	21	0.000111	10.6899	15
0 8 7 4 2 6 1 3 5	39	22	2.60E-05	12.05797	18
7 2 0 5 4 3 8 6 1	4038	28	0.004351	11.15515	14
5 3 0 6 7 1 8 2 4	90	20	5.90E-05	9.64516	16
5 7 2 8 3 6 4 0 1	2905	27	0.002896	10.86363	17

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
3 7 8 1 4 6 5 0 2	2301	27	0.002364	11.8785	15
7 4 5 8 6 3 2 0 1	698	25	1.04E-03	10.87457	19
0 4 1 8 2 5 3 7 6	2190	24	0.002637	9.48784	10
5 1 7 2 3 6 8 4 0	936	24	0.000984	11.83721	16
6 3 4 8 2 1 5 7 0	238	22	0.000371	9.94118	16
2 0 1 5 7 6 4 8 3	3038	27	0.003395	10.95796	15
7 8 0 6 3 1 2 5 4	1632	26	0.001579	10.81997	18
6 2 4 3 7 0 5 1 8	4306	25	0.004538	10.30134	11
7 5 4 8 3 6 0 2 1	739	26	0.000451	11.90288	20
3 8 4 5 7 1 0 6 2	382	20	0.000236	9.3811	14
5 6 2 8 7 1 0 3 4	2084	26	0.00141	10.70319	16
3 2 4 6 5 8 0 7 1	99	16	5.90E-05	7.57627	10
7 5 1 6 8 4 2 0 3	2764	27	0.001886	11.43141	17
3 5 2 0 8 1 4 6 7	428	19	0.00025	8.67215	11
8 0 6 7 1 3 5 2 4	715	25	0.000472	13.0834	21
2 5 8 4 1 0 6 3 7	68	15	4.30E-05	7.46341	11
7 0 2 1 8 6 3 4 5	34	17	2.20E-05	9.30159	13
2 1 5 3 8 0 6 7 4	121	15	7.20E-05	7.40476	7
3 8 6 4 7 0 1 5 2	993	25	0.00072	10.74262	17
1 0 7 2 4 3 6 8 5	163	17	9.60E-05	8.95406	11
3 6 7 5 8 0 4 1 2	2389	27	0.00171	11.71183	17
6 2 0 3 1 4 8 7 5	369	20	0.000214	8.35191	8
7 1 5 4 0 3 2 6 8	356	20	0.000205	8.59204	12
8 0 7 4 6 1 5 2 3	1461	27	0.001065	11.14298	21
8 2 0 5 7 6 1 3 4	854	26	0.000622	11.48806	18
3 8 5 7 0 1 6 4 2	730	22	0.000603	9.60705	12
3 5 4 1 7 6 0 2 8	257	22	0.00015	11.32333	14
0 2 8 5 4 1 7 3 6	414	22	0.00036	9.85836	12
4 3 7 0 6 1 5 8 2	181	19	0.000118	9.90323	17
2 1 3 4 6 5 0 7 8	336	20	0.000295	9.12263	8
1 0 5 4 6 2 7 3 8	707	21	5.35E-04	8.57711	9
7 2 3 1 5 4 8 6 0	1467	24	0.001077	11.03799	14
5 7 2 6 4 0 8 3 1	1319	25	0.000932	10.78428	13

### 3.5. Resultados para o IDA\*

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
5 6 2 7 1 8 3 4 0	2631	22	0.002089	9.77136	12
5 3 2 8 7 1 4 0 6	3276	23	0.00255	10.59196	15

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
1 0 7 5 2 4 3 8 6	145	17	1.11E-04	9.9	13
3 6 4 2 8 0 5 7 1	2720	25	0.001906	11.76873	17
0 6 1 7 4 2 3 8 5	165	16	1.29E-04	7.10105	10
0 3 8 2 1 4 7 6 5	1734	22	0.001244	9.23863	12
0 8 2 1 5 6 7 3 4	1741	22	0.00126	10.41792	14
5 0 2 6 4 8 1 7 3	439	21	3.26E-04	10.71409	11
3 0 8 4 1 2 6 7 5	464	17	0.000352	7.57071	7
7 2 6 3 1 5 8 0 4	611	21	0.000418	11.44719	13
2 4 7 0 3 6 8 1 5	724	23	4.68E-04	11.69583	15
2 1 6 0 4 3 7 5 8	1659	23	0.001126	10.90403	11
1 2 8 0 3 7 5 6 4	372	19	2.58E-04	9.04754	13
1 4 8 2 7 6 0 3 5	1420	22	0.000934	9.64889	14
5 0 2 1 6 8 7 3 4	465	19	3.17E-04	8.19576	13
6 2 1 5 0 4 3 8 7	2130	22	0.001412	9.63283	10
1 8 0 4 5 2 6 7 3	794	20	5.42E-04	9.2099	10
7 6 4 8 1 3 5 0 2	71	21	5.40E-05	12.61864	19
1 8 7 5 0 4 2 3 6	456	22	0.000287	11.52949	18
2 8 0 4 1 7 5 6 3	368	22	0.00025	10.87642	16
7 8 1 3 6 2 4 5 0	27	16	1.80E-05	9.33962	14
1 4 7 3 6 2 0 8 5	76	16	5.80E-05	8.46269	10
5 2 3 4 7 1 8 0 6	2805	25	0.001759	11.12269	15
5 1 3 2 6 4 7 8 0	805	22	0.000533	10.21864	14
1 0 2 5 8 6 4 7 3	1666	23	0.001089	10.27133	13
4 7 6 0 5 2 3 8 1	2470	25	0.001609	10.33398	15
5 8 2 1 7 6 3 0 4	1294	21	0.00085	9.67376	15
3 0 2 6 1 4 5 7 8	100	13	6.60E-05	6.92265	7
2 0 1 7 5 3 8 6 4	1609	23	0.000979	11.24387	13
8 1 0 5 3 7 2 4 6	225	24	0.000145	13.86685	16
0 2 6 5 4 7 1 3 8	1820	24	0.001139	11.51377	14
4 5 0 1 7 2 3 8 6	129	16	8.50E-05	9.39462	12
0 6 3 5 8 2 1 7 4	37	18	3.70E-05	10.05882	16
1 4 8 0 7 5 2 6 3	1500	23	0.000934	10.92209	13
1 5 0 8 4 3 2 7 6	4075	26	0.002623	11.35971	14
2 3 6 8 1 0 5 4 7	5873	27	0.00357	12.11163	17
1 6 0 7 3 8 4 5 2	487	22	0.000321	11.67448	14
8 4 3 1 6 5 0 7 2	5296	26	0.003294	11.09156	14
3 8 2 7 5 1 0 6 4	2349	22	0.001471	9.75955	12
7 2 3 6 4 8 1 0 5	5296	25	0.00327	10.85425	13
3 1 2 4 0 8 5 7 6	125	14	9.00E-05	7.87215	8
8 5 3 1 2 6 4 0 7	3436	25	2.09E-03	11.43712	19
2 0 8 6 1 3 4 7 5	1193	21	0.000738	9.66766	11
3 6 7 1 2 8 4 5 0	9239	26	0.005248	10.24226	16
0 3 6 1 2 8 4 7 5	2256	24	0.000995	10.42571	14
4 8 6 5 0 7 1 3 2	626	24	0.000277	13.10795	20

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
7 2 0 1 8 6 3 4 5	92	18	4.50E-05	9.95	14
4 0 7 1 3 2 5 8 6	1145	23	0.000509	11.02319	15
1 4 3 0 5 8 7 6 2	1201	21	0.000543	10.7044	11
1 3 6 5 8 4 0 2 7	5557	28	0.002439	12.39827	16
3 1 6 4 0 8 7 5 2	730	20	0.000327	9.95339	12
8 0 5 1 4 3 7 2 6	9355	27	4.27E-03	10.63338	15
1 0 2 8 7 3 4 6 5	661	19	0.000313	8.768	11
5 8 1 4 7 3 2 6 0	2195	26	0.001003	12.07801	16
6 4 1 2 0 3 7 8 5	257	18	0.000128	9.27335	12
6 1 7 4 8 3 5 2 0	2440	24	1.12E-03	10.65915	16
0 1 5 3 8 7 6 4 2	339	18	0.000173	8.49228	8
7 8 2 6 4 3 0 1 5	2316	24	0.001078	10.8637	12
6 0 8 7 4 3 5 2 1	272	23	1.36E-04	13.1347	17
5 4 0 7 6 2 8 3 1	3401	24	1.60E-03	10.81849	16
5 6 1 8 7 0 2 4 3	9544	27	0.004563	11.49825	19
1 6 7 4 2 0 3 5 8	8845	25	0.004432	9.66691	13
5 3 6 4 7 2 1 0 8	360	21	0.000194	10.34206	15
0 8 7 4 2 6 1 3 5	103	22	5.60E-05	13.1092	18
7 2 0 5 4 3 8 6 1	11359	28	0.005721	11.54953	14
5 3 0 6 7 1 8 2 4	406	20	2.30E-04	9.61314	16
5 7 2 8 3 6 4 0 1	8302	27	0.004166	11.22181	17
3 7 8 1 4 6 5 0 2	6762	27	0.002491	11.85511	15
7 4 5 8 6 3 2 0 1	2421	25	9.20E-04	11.35171	19
0 4 1 8 2 5 3 7 6	3944	24	0.001564	9.62027	10
5 1 7 2 3 6 8 4 0	899	24	0.000349	11.50034	16
6 3 4 8 2 1 5 7 0	868	22	0.000352	10.48041	16
2 0 1 5 7 6 4 8 3	14476	27	0.006035	10.90169	15
7 8 0 6 3 1 2 5 4	3141	26	0.001367	11.7216	18
6 2 4 3 7 0 5 1 8	8979	25	0.004072	9.91542	11
7 5 4 8 3 6 0 2 1	1631	26	0.000735	11.57824	20
3 8 4 5 7 1 0 6 2	413	20	0.0002	9.50872	14
5 6 2 8 7 1 0 3 4	8936	26	0.004283	10.44117	16
3 2 4 6 5 8 0 7 1	166	16	1.05E-04	8.79452	10
7 5 1 6 8 4 2 0 3	7986	27	0.003942	11.35055	17
3 5 2 0 8 1 4 6 7	490	19	0.00026	8.28503	11
8 0 6 7 1 3 5 2 4	324	25	0.000154	14.1109	21
2 5 8 4 1 0 6 3 7	56	15	3.90E-05	7.93	11
7 0 2 1 8 6 3 4 5	83	17	4.50E-05	9.5411	13
2 1 5 3 8 0 6 7 4	186	15	8.40E-05	7.25234	7
3 8 6 4 7 0 1 5 2	2713	25	0.001367	11.4584	17
1 0 7 2 4 3 6 8 5	206	17	1.14E-04	9.22099	11
3 6 7 5 8 0 4 1 2	5691	27	0.00298	11.79267	17
6 2 0 3 1 4 8 7 5	1408	20	0.000524	8.11461	8
7 1 5 4 0 3 2 6 8	573	20	0.000219	9.39425	12

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
8 0 7 4 6 1 5 2 3	2764	27	0.001031	11.32057	21
8 2 0 5 7 6 1 3 4	2791	26	0.001045	10.97028	18
3 8 5 7 0 1 6 4 2	2006	22	0.000812	9.70714	12
3 5 4 1 7 6 0 2 8	1238	22	0.000484	10.94393	14
0 2 8 5 4 1 7 3 6	1016	22	0.000408	10.96005	12
4 3 7 0 6 1 5 8 2	244	19	0.000114	9.9058	17
2 1 3 4 6 5 0 7 8	722	20	0.000278	9.39951	8
1 0 5 4 6 2 7 3 8	2213	21	8.94E-04	8.08773	9
7 2 3 1 5 4 8 6 0	2265	24	0.000895	11.26548	14
5 7 2 6 4 0 8 3 1	3613	25	0.00145	10.67158	13

### 3.6. Resultados para o A\* 15-puzzle

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
5 6 2 7 1 8 3 4 0	14028344	57	29.6936	27.1869	53
5 3 2 8 7 1 4 0 6	4415279	55	7.5728	23.39483	40
1 0 7 5 2 4 3 8 6	-	-	-	-	-
3 6 4 2 8 0 5 7 1	5253685	56	1.63E+01	26.62079	47
0 6 1 7 4 2 3 8 5	2021382	56	6.0646	28.1532	43
0 3 8 2 1 4 7 6 5	969356	52	2.1166	27.41649	37
0 8 2 1 5 6 7 3 4	7170013	52	3.60E+01	23.38374	35
5 0 2 6 4 8 1 7 3	2618503	50	12.101	24.42452	41
3 0 8 4 1 2 6 7 5	313211	46	0.651	21.50374	39
7 2 6 3 1 5 8 0 4	-	-	-	-	-
2 4 7 0 3 6 8 1 5	3525006	57	1.09E+01	28.75055	45
2 1 6 0 4 3 7 5 8	32334	45	0.097179	26.2365	31
1 2 8 0 3 7 5 6 4	831333	46	2.30E+00	19.50749	35
1 4 8 2 7 6 0 3 5	-	-	-	-	-
5 0 2 1 6 8 7 3 4	-	-	-	-	-
6 2 1 5 0 4 3 8 7	909219	42	1.5864	18.65163	25
1 8 0 4 5 2 6 7 3	-	-	-	-	-
7 6 4 8 1 3 5 0 2	1267588	55	5.9205	27.25944	39
1 8 7 5 0 4 2 3 6	154092	46	0.4744	22.9872	39
2 8 0 4 1 7 5 6 3	1995813	52	4.8302	24.57298	39
7 8 1 3 6 2 4 5 0	5668025	54	26.729	26.4034	39
1 4 7 3 6 2 0 8 5	-	-	-	-	-
5 2 3 4 7 1 8 0 6	1398857	49	2.8082	24.27706	44
5 1 3 2 6 4 7 8 0	4691710	54	19.645	26.31223	33
1 0 2 5 8 6 4 7 3	6227205	52	24.137	24.70027	27

Estado Inicial	Total Nodos	g*	Tempo para Solução	Média de H	h(n0)
4 7 6 0 5 2 3 8 1	-	-	-	-	-
5 8 2 1 7 6 3 0 4	-	-	-	-	-
3 0 2 6 1 4 5 7 8	909442	52	3.1219	27.87271	37
2 0 1 7 5 3 8 6 4	3917549	54	9.7661	26.11907	36
8 1 0 5 3 7 2 4 6	215990	47	0.38162	24.84019	31
0 2 6 5 4 7 1 3 8	192534	50	0.30439	28.16482	37
4 5 0 1 7 2 3 8 6	-	-	-	-	-
0 6 3 5 8 2 1 7 4	-	-	-	-	-
1 4 8 0 7 5 2 6 3	2063117	52	7.7278	25.98247	33
1 5 0 8 4 3 2 7 6	4626661	55	18.177	26.97481	36
2 3 6 8 1 0 5 4 7	2309697	52	9.6764	25.79149	34
1 6 0 7 3 8 4 5 2	-	-	-	-	-
8 4 3 1 6 5 0 7 2	827864	53	2.9381	28.71006	41
3 8 2 7 5 1 0 6 4	1118025	49	2.1992	24.28077	39
7 2 3 6 4 8 1 0 5	6540243	54	25.803	26.38056	41
3 1 2 4 0 8 5 7 6	5727374	54	9.62E+02	26.12191	44
8 5 3 1 2 6 4 0 7	48447	42	0.11858	23.30025	38
2 0 8 6 1 3 4 7 5	7332466	64	931.65	33.05283	47
3 6 7 1 2 8 4 5 0	2731989	50	9.9433	24.6075	38
0 3 6 1 2 8 4 7 5	539196	51	9.12E-01	27.31613	46
4 8 6 5 0 7 1 3 2	1430455	49	5.06	22.91793	44
7 2 0 1 8 6 3 4 5	179689	47	0.35425	25.47536	37
4 0 7 1 3 2 5 8 6	-	-	-	-	-
1 4 3 0 5 8 7 6 2	-	-	-	-	-
1 3 6 5 8 4 0 2 7	4399444	53	16.106	25.09939	46
3 1 6 4 0 8 7 5 2	-	-	-	-	-
8 0 5 1 4 3 7 2 6	-	-	-	-	-
1 0 2 8 7 3 4 6 5	-	-	-	-	-
5 8 1 4 7 3 2 6 0	-	-	-	-	-
6 4 1 2 0 3 7 8 5	152123	41	0.351	20.6962	42
6 1 7 4 8 3 5 2 0	-	-	-	-	-
0 1 5 3 8 7 6 4 2	484048	50	1.8497	26.11739	43
7 8 2 6 4 3 0 1 5	506538	51	1.4567	25.54531	41
6 0 8 7 4 3 5 2 1	-	-	-	-	-
5 4 0 7 6 2 8 3 1	-	-	-	-	-
5 6 1 8 7 0 2 4 3	508957	45	1.0247	21.72712	38
1 6 7 4 2 0 3 5 8	1828847	57	3.2849	29.08457	45
5 3 6 4 7 2 1 0 8	-	-	-	-	-
0 8 7 4 2 6 1 3 5	5622335	51	2.85E+01	23.6183	33
7 2 0 5 4 3 8 6 1	920623	47	4.55E+00	22.62283	42
5 3 0 6 7 1 8 2 4	-	-	-	-	-
5 7 2 8 3 6 4 0 1	-	-	-	-	-
3 7 8 1 4 6 5 0 2	5471060	51	25.165	25.118	35
7 4 5 8 6 3 2 0 1	4579005	53	25.231	25.34284	33

<b>Estado Inicial</b>	<b>Total Nodos</b>	<b>g*</b>	<b>Tempo para Solução</b>	<b>Média de H</b>	<b>h(n0)</b>
0 4 1 8 2 5 3 7 6	-	-	-	-	-
5 1 7 2 3 6 8 4 0	557862	44	2.5532	20.63013	42
6 3 4 8 2 1 5 7 0	-	-	-	-	-
2 0 1 5 7 6 4 8 3	188717	49	1.3434	23.87312	37
7 8 0 6 3 1 2 5 4	1373939	56	3.02E+00	28.77162	48
6 2 4 3 7 0 5 1 8	3440513	48	12.967	22.06025	38
7 5 4 8 3 6 0 2 1	-	-	-	-	-
3 8 4 5 7 1 0 6 2	2184110	54	6.4278	27.59798	40
5 6 2 8 7 1 0 3 4	619299	53	1.0867	27.38071	41
3 2 4 6 5 8 0 7 1	68633	42	0.10827	21.78124	36
7 5 1 6 8 4 2 0 3	3951356	57	21.452	26.91358	51
3 5 2 0 8 1 4 6 7	744209	53	2.8418	28.05176	47
8 0 6 7 1 3 5 2 4	-	-	-	-	-
2 5 8 4 1 0 6 3 7	1900358	49	6.4229	24.12778	35
7 0 2 1 8 6 3 4 5	-	-	-	-	-
2 1 5 3 8 0 6 7 4	158355	44	0.47197	20.88866	31
3 8 6 4 7 0 1 5 2	195222	45	0.41096	22.29049	35
1 0 7 2 4 3 6 8 5	4681483	52	16.653	25.96204	37
3 6 7 5 8 0 4 1 2	-	-	-	-	-
6 2 0 3 1 4 8 7 5	3559259	54	12.724	26.46187	38
7 1 5 4 0 3 2 6 8	820923	50	3.0792	26.0792	47
8 0 7 4 6 1 5 2 3	-	-	-	-	-
8 2 0 5 7 6 1 3 4	-	-	-	-	-
3 8 5 7 0 1 6 4 2	438960	46	1.7397	20.96523	40
3 5 4 1 7 6 0 2 8	276325	53	0.99774	27.76658	44
0 2 8 5 4 1 7 3 6	751475	50	1.5638	25.06341	43
4 3 7 0 6 1 5 8 2	1263033	49	2.2925	22.92223	44
2 1 3 4 6 5 0 7 8	191601	44	0.33853	21.26782	39
1 0 5 4 6 2 7 3 8	-	-	-	-	-
7 2 3 1 5 4 8 6 0	-	-	-	-	-
5 7 2 6 4 0 8 3 1	-	-	-	-	-