UFMG

Universidade Federal de Minas Gerais

8 PUZZLE - README

Autor:
Daniel Martins Reis

Matrícula:
2019697267

UFMG | ICEx
DEPARTAMENTO DE
CIÊNCIA DA COMPUTAÇÃO

Sumário

1 Testes de execução

Estado inicial:
$$\begin{bmatrix} 8 & 6 & 7 \\ 2 & 5 & 4 \\ 3 & 0 & 1 \end{bmatrix}$$

Estado objetivo:
$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{bmatrix}$$

Observe abaixo como executar o código:

```
python tp_ia_daniel_reis.py 3 3 [[8,6,7],[2,5,4],[3,0,1]]
                               [[1,2,3],[4,5,6],[7,8,0]] 0 31
```

Ressalta-se que essa implementação suporta o N puzzle. Basta passar o tamanho nxn e as matrizes de tamanho nxn. Note que os 2 primeiros parâmetros se remetem ao tamanho da matriz. Logo, os próximos 2 parâmetros se remetem aos valores da matriz inicial e da matriz objetivo respectivamente. O próximo parâmetro se refere ao algoritmo escolhido para executar, sendo:

- 0 - Executar todos os algoritmos;

- 1 - Executar apenas o Breadth First Search;

- 2 - Executar apenas o Uniform Cost Search;

- 3 - Executar apenas o Iterative Deepening Search;

- 4 - Executar apenas o A Star Search Heuristic 1;

- 5 - Executar apenas o A Star Search Heuristic 2;

- 6 - Executar apenas o Greedy Best First Search Heuristic 1;

- 7 - Executar apenas o Greedy Best First Search Heuristic 2;

- 8 - Executar apenas o Hill Climbing Search Heuristic 1;

- 9 - Executar apenas o Hill Climbing Search Heuristic 2.

O último parâmetro se refere ao nome do arquivo a ser salvo com a solução do problema obtida pelo(s) algoritmo(s) executado(s). Observe nas próximas seções os resultados obtidos na execução com as configurações acima.

1.1 Breadth First Search

Estado inicial
[8, 6, 7] [2, 5, 4] [3, 0, 1]

———————————————————————

Estado objetivo
[1, 2, 3] [4, 5, 6] [7, 8, 0]

———————————————————————

********** Busca sem Informação ***********

———————————————————————

Breadth First Search:
Resultados
Caminho: 0 1 4 9 20 36 64 109 197 316 522 825 1376 2173 3573 5552 8960 13543
21109 30466 44738 60599 82417 103426 127880 146599 163908 173362 179251 180872
181409 181439

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[7, 4, 3] [8, 0, 5] [2, 1, 6]
[8, 6, 7] [2, 5, 4] [0, 3, 1]	[7, 4, 3] [8, 1, 5] [2, 0, 6]
[8, 6, 7] [0, 5, 4] [2, 3, 1]	[7, 4, 3] [8, 1, 5] [0, 2, 6]
[8, 6, 7] [5, 0, 4] [2, 3, 1]	[7, 4, 3] [0, 1, 5] [8, 2, 6]
[8, 0, 7] [5, 6, 4] [2, 3, 1]	[0, 4, 3] [7, 1, 5] [8, 2, 6]
[8, 7, 0] [5, 6, 4] [2, 3, 1]	[4, 0, 3] [7, 1, 5] [8, 2, 6]
[8, 7, 4] [5, 6, 0] [2, 3, 1]	[4, 1, 3] [7, 0, 5] [8, 2, 6]
[8, 7, 4] [5, 0, 6] [2, 3, 1]	[4, 1, 3] [7, 2, 5] [8, 0, 6]
[8, 7, 4] [5, 3, 6] [2, 0, 1]	[4, 1, 3] [7, 2, 5] [0, 8, 6]
[8, 7, 4] [5, 3, 6] [2, 1, 0]	[4, 1, 3] [0, 2, 5] [7, 8, 6]
[8, 7, 4] [5, 3, 0] [2, 1, 6]	[0, 1, 3] [4, 2, 5] [7, 8, 6]
[8, 7, 4] [5, 0, 3] [2, 1, 6]	[1, 0, 3] [4, 2, 5] [7, 8, 6]
[8, 7, 4] [0, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 0, 5] [7, 8, 6]
[0, 7, 4] [8, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 5, 0] [7, 8, 6]
[7, 0, 4] [8, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 5, 6] [7, 8, 0]
[7, 4, 0] [8, 5, 3] [2, 1, 6]	
[7, 4, 3] [8, 5, 0] [2, 1, 6]	

Custo do caminho: 31
Tempo total: 1334.4056115150452 s
Total de nós: 181440
Total de nós explorados: 181410

———————————————————————

1.2 Uniform Cost Search

Estado inicial
[8, 6, 7] [2, 5, 4] [3, 0, 1]

Estado objetivo
[1, 2, 3] [4, 5, 6] [7, 8, 0]

********** Busca sem Informação **********

Uniform Cost Search:
Resultados
Caminho: 0 1 8 17 31 58 98 174 281 473 742 1239 1948 3239 4992 8129 12232 19210 27745 40996 55711 76531 96775 121097 137155 158852 170007 177396 180236 180707 181398 181438

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[8, 1, 3] [2, 5, 6] [0, 4, 7]
[8, 6, 7] [2, 5, 4] [0, 3, 1]	[8, 1, 3] [2, 5, 6] [4, 0, 7]
[8, 6, 7] [0, 5, 4] [2, 3, 1]	[8, 1, 3] [2, 5, 6] [4, 7, 0]
[8, 6, 7] [5, 0, 4] [2, 3, 1]	[8, 1, 3] [2, 5, 0] [4, 7, 6]
[8, 6, 7] [5, 3, 4] [2, 0, 1]	[8, 1, 3] [2, 0, 5] [4, 7, 6]
[8, 6, 7] [5, 3, 4] [2, 1, 0]	[8, 1, 3] [0, 2, 5] [4, 7, 6]
[8, 6, 7] [5, 3, 0] [2, 1, 4]	[0, 1, 3] [8, 2, 5] [4, 7, 6]
[8, 6, 0] [5, 3, 7] [2, 1, 4]	[1, 0, 3] [8, 2, 5] [4, 7, 6]
[8, 0, 6] [5, 3, 7] [2, 1, 4]	[1, 2, 3] [8, 0, 5] [4, 7, 6]
[8, 3, 6] [5, 0, 7] [2, 1, 4]	[1, 2, 3] [0, 8, 5] [4, 7, 6]
[8, 3, 6] [5, 1, 7] [2, 0, 4]	[1, 2, 3] [4, 8, 5] [0, 7, 6]
[8, 3, 6] [5, 1, 7] [2, 4, 0]	[1, 2, 3] [4, 8, 5] [7, 0, 6]
[8, 3, 6] [5, 1, 0] [2, 4, 7]	[1, 2, 3] [4, 0, 5] [7, 8, 6]
[8, 3, 0] [5, 1, 6] [2, 4, 7]	[1, 2, 3] [4, 5, 0] [7, 8, 6]
[8, 0, 3] [5, 1, 6] [2, 4, 7]	[1, 2, 3] [4, 5, 6] [7, 8, 0]
[8, 1, 3] [5, 0, 6] [2, 4, 7]	
[8, 1, 3] [0, 5, 6] [2, 4, 7]	

Custo do caminho: 31
Tempo total: 2559.7401056289673 s
Total de nós: 181440
Total de nós explorados: 181438

1.3 Iterative Deepening Search

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

********** Busca sem Informação ***********

Iterative Deepening Search:
Resultados
Caminho:0 3 6 8 9 10 77345 77346 86797 86798 86834 39998 86849 86855 86859 86860 103754 103755 134823 124667 124663 124666 138008 40365 132895 132896 140808 27225 27221 27226 175258 175259

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[7, 4, 2] [8, 0, 3] [5, 1, 6]
[8, 6, 7] [2, 0, 4] [3, 5, 1]	[7, 4, 2] [8, 1, 3] [5, 0, 6]
[8, 0, 7] [2, 6, 4] [3, 5, 1]	[7, 4, 2] [8, 1, 3] [0, 5, 6]
[8, 7, 0] [2, 6, 4] [3, 5, 1]	[7, 4, 2] [0, 1, 3] [8, 5, 6]
[8, 7, 4] [2, 6, 0] [3, 5, 1]	[0, 4, 2] [7, 1, 3] [8, 5, 6]
[8, 7, 4] [2, 0, 6] [3, 5, 1]	[4, 0, 2] [7, 1, 3] [8, 5, 6]
[8, 7, 4] [0, 2, 6] [3, 5, 1]	[4, 1, 2] [7, 0, 3] [8, 5, 6]
[8, 7, 4] [3, 2, 6] [0, 5, 1]	[4, 1, 2] [7, 5, 3] [8, 0, 6]
[8, 7, 4] [3, 2, 6] [5, 0, 1]	[4, 1, 2] [7, 5, 3] [0, 8, 6]
[8, 7, 4] [3, 2, 6] [5, 1, 0]	[4, 1, 2] [0, 5, 3] [7, 8, 6]
[8, 7, 4] [3, 2, 0] [5, 1, 6]	[0, 1, 2] [4, 5, 3] [7, 8, 6]
[8, 7, 4] [3, 0, 2] [5, 1, 6]	[1, 0, 2] [4, 5, 3] [7, 8, 6]
[8, 7, 4] [0, 3, 2] [5, 1, 6]	[1, 2, 0] [4, 5, 3] [7, 8, 6]
[0, 7, 4] [8, 3, 2] [5, 1, 6]	[1, 2, 3] [4, 5, 0] [7, 8, 6]
[7, 0, 4] [8, 3, 2] [5, 1, 6]	[1, 2, 3] [4, 5, 6] [7, 8, 0]
[7, 4, 0] [8, 3, 2] [5, 1, 6]	
[7, 4, 2] [8, 3, 0] [5, 1, 6]	

Custo do caminho: 31
Tempo total: 371.8457341194153 s
Total de nós: 455898
Total de nós explorados: 175248

Segue a execução passo a passo da busca em profundidade limitada a cada altura mencionada abaixo.

Nodes: 4 - 4 - depth: 1 - time: 0.022385597229003906
Nodes: 9 - 9 - depth: 2 - time: 0.0196230411529541
Nodes: 19 - 19 - depth: 3 - time: 0.01960301399230957
Nodes: 33 - 33 - depth: 4 - time: 0.022849082946777344
Nodes: 61 - 61 - depth: 5 - time: 0.025855302810668945
Nodes: 103 - 103 - depth: 6 - time: 0.023327350616455078
Nodes: 183 - 185 - depth: 7 - time: 0.030164003372192383
Nodes: 291 - 297 - depth: 8 - time: 0.03855729103088379
Nodes: 493 - 513 - depth: 9 - time: 0.0458528995513916
Nodes: 771 - 831 - depth: 10 - time: 0.06493997573852539
Nodes: 1295 - 1436 - depth: 11 - time: 0.09885168075561523
Nodes: 2021 - 2263 - depth: 12 - time: 0.14977622032165527
Nodes: 3369 - 3828 - depth: 13 - time: 0.23582839965820312
Nodes: 5173 - 6051 - depth: 14 - time: 0.3761587142944336
Nodes: 8456 - 10170 - depth: 15 - time: 0.6082773208618164
Nodes: 12649 - 15598 - depth: 16 - time: 0.9546256065368652
Nodes: 19971 - 25392 - depth: 17 - time: 1.541250228881836
Nodes: 28567 - 37709 - depth: 18 - time: 2.3610212802886963
Nodes: 42497 - 58862 - depth: 19 - time: 3.719752311706543
Nodes: 57210 - 83227 - depth: 20 - time: 5.51120662689209
Nodes: 78931 - 122459 - depth: 21 - time: 8.150865077972412
Nodes: 98758 - 163437 - depth: 22 - time: 11.518288850784302
Nodes: 123890 - 223915 - depth: 23 - time: 15.947763681411743
Nodes: 142087 - 280571 - depth: 24 - time: 21.08375859260559
Nodes: 161065 - 357728 - depth: 25 - time: 27.05350375175476
Nodes: 170994 - 422976 - depth: 26 - time: 33.45507884025574
Nodes: 178353 - 506438 - depth: 27 - time: 40.4459388256073
Nodes: 180434 - 573598 - depth: 28 - time: 47.15860319137573
Nodes: 181312 - 657889 - depth: 29 - time: 54.157512187957764
Nodes: 181438 - 725247 - depth: 30 - time: 60.92508125305176
Nodes: 175260 - 455898 - depth: 31 - time: 36.15464425086975

1.4   A Star Search Heuristic 1

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

───────────────────────────────

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

───────────────────────────────

********** Busca com Informação ***********

───────────────────────────────

A Star Search Heuristic 1:
Resultados
Caminho: 0 3 4 10 20 35 65 112 195 314 524 829 1381 2180 3580 5561 8974 13575 21124 30490 44661 60513 82296 103338 127634 146329 163721 173274 179164 180808 181389 181439

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[2, 3, 6] [5, 8, 7] [1, 4, 0]
[8, 6, 7] [2, 0, 4] [3, 5, 1]	[2, 3, 6] [5, 8, 0] [1, 4, 7]
[8, 6, 7] [0, 2, 4] [3, 5, 1]	[2, 3, 6] [5, 0, 8] [1, 4, 7]
[8, 6, 7] [3, 2, 4] [0, 5, 1]	[2, 3, 6] [0, 5, 8] [1, 4, 7]
[8, 6, 7] [3, 2, 4] [5, 0, 1]	[2, 3, 6] [1, 5, 8] [0, 4, 7]
[8, 6, 7] [3, 2, 4] [5, 1, 0]	[2, 3, 6] [1, 5, 8] [4, 0, 7]
[8, 6, 7] [3, 2, 0] [5, 1, 4]	[2, 3, 6] [1, 5, 8] [4, 7, 0]
[8, 6, 0] [3, 2, 7] [5, 1, 4]	[2, 3, 6] [1, 5, 0] [4, 7, 8]
[8, 0, 6] [3, 2, 7] [5, 1, 4]	[2, 3, 0] [1, 5, 6] [4, 7, 8]
[0, 8, 6] [3, 2, 7] [5, 1, 4]	[2, 0, 3] [1, 5, 6] [4, 7, 8]
[3, 8, 6] [0, 2, 7] [5, 1, 4]	[0, 2, 3] [1, 5, 6] [4, 7, 8]
[3, 8, 6] [2, 0, 7] [5, 1, 4]	[1, 2, 3] [0, 5, 6] [4, 7, 8]
[3, 0, 6] [2, 8, 7] [5, 1, 4]	[1, 2, 3] [4, 5, 6] [0, 7, 8]
[0, 3, 6] [2, 8, 7] [5, 1, 4]	[1, 2, 3] [4, 5, 6] [7, 0, 8]
[2, 3, 6] [0, 8, 7] [5, 1, 4]	[1, 2, 3] [4, 5, 6] [7, 8, 0]
[2, 3, 6] [5, 8, 7] [0, 1, 4]	
[2, 3, 6] [5, 8, 7] [1, 0, 4]	

Custo do caminho: 31
Tempo total: 1278.3032760620117 s
Total de nós: 181440
Total de nós explorados: 181439

───────────────────────────────

1.5 A Star Search Heuristic 2

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

─────────────────────────────────

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

─────────────────────────────────

********** Busca com Informação ***********

─────────────────────────────────

A Star Search Heuristic 2:
Resultados
Caminho: 0 1 8 9 20 36 64 109 197 316 522 825 1376 2173 3573 5552 8960 13543 21109 30466 44738 60599 82417 103426 127880 146599 163908 173362 179251 180872 181409 181439

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[7, 4, 3] [8, 0, 5] [2, 1, 6]
[8, 6, 7] [2, 5, 4] [0, 3, 1]	[7, 4, 3] [8, 1, 5] [2, 0, 6]
[8, 6, 7] [0, 5, 4] [2, 3, 1]	[7, 4, 3] [8, 1, 5] [0, 2, 6]
[8, 6, 7] [5, 0, 4] [2, 3, 1]	[7, 4, 3] [0, 1, 5] [8, 2, 6]
[8, 0, 7] [5, 6, 4] [2, 3, 1]	[0, 4, 3] [7, 1, 5] [8, 2, 6]
[8, 7, 0] [5, 6, 4] [2, 3, 1]	[4, 0, 3] [7, 1, 5] [8, 2, 6]
[8, 7, 4] [5, 6, 0] [2, 3, 1]	[4, 1, 3] [7, 0, 5] [8, 2, 6]
[8, 7, 4] [5, 0, 6] [2, 3, 1]	[4, 1, 3] [7, 2, 5] [8, 0, 6]
[8, 7, 4] [5, 3, 6] [2, 0, 1]	[4, 1, 3] [7, 2, 5] [0, 8, 6]
[8, 7, 4] [5, 3, 6] [2, 1, 0]	[4, 1, 3] [0, 2, 5] [7, 8, 6]
[8, 7, 4] [5, 3, 0] [2, 1, 6]	[0, 1, 3] [4, 2, 5] [7, 8, 6]
[8, 7, 4] [5, 0, 3] [2, 1, 6]	[1, 0, 3] [4, 2, 5] [7, 8, 6]
[8, 7, 4] [0, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 0, 5] [7, 8, 6]
[0, 7, 4] [8, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 5, 0] [7, 8, 6]
[7, 0, 4] [8, 5, 3] [2, 1, 6]	[1, 2, 3] [4, 5, 6] [7, 8, 0]
[7, 4, 0] [8, 5, 3] [2, 1, 6]	
[7, 4, 3] [8, 5, 0] [2, 1, 6]	

Custo do caminho: 31
Tempo total: 1288.9054596424103 s
Total de nós: 181440
Total de nós explorados: 181439

─────────────────────────────────

1.6 Greedy Best First Search Heuristic 1

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

********** Busca com Informação ***********

Greedy Best First Search Heuristic 1:
Resultados
Caminho: 0 1 4 5 7 10 12 13 15 16 18 21 23 24 26 27 30 32 34 36 37 38 40 41 43 46 48 49 51 52 54 57 59 60 62 64 65 66 68 69 72 75 76 78 79 80 82 84 85 86 88 90 91 92 94 95 97 100 102 103 105 106 108 111 113 114 116 117 120 123 124 126 127 128 130 132 133 134 136 138 139 140 142 143 145 148 150 151 153 154 156 159 161 162 164 165 168 171 172 174 175 176 178 180 181 182 184 185 187 190 192 193 195 196 198 201 203 204 206 207 209 212 214 215 217 218 220 224 225 227 230 232 233 234 236 239 241 242 244 245 247 250 252 253 255 257 258 259 261 262 264 267 269 270 272 273 275 278 280 281 283 284 287 290 291 293 294 295 297 298 300 303 305 306 308 309 311 314 316 317 319 321 322 323 325 326 329 331 333 334 336 339 341 342 344 345 347 350 352 353 355 356 358 361 363 364 366 367 369 373 374 375 377 378 381 384 385 386 389 392 393 395 396 397 399 400 402 405 407 409 410 414 415 416 418 420 421 422 424 426 427 428 430 431 433 436 438 440 442 445 446 447 449 450 453 455 457 459 460 462 465 466 468 469 472 474 476 478 479 480 482 483 485 489 490 491 493 494 496 499 501 503 504 507 509 511 513 516 517 519 521 524 525 526 528 530 531 532 534 536 537 538 540 541 543 546 548 550 551 555 556 557 559 560 562 566 567 569 571 574

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[5, 8, 0] [4, 7, 6] [2, 3, 1]
[8, 6, 7] [2, 5, 4] [0, 3, 1]	[5, 0, 8] [4, 7, 6] [2, 3, 1]
[8, 6, 7] [0, 5, 4] [2, 3, 1]	[0, 5, 8] [4, 7, 6] [2, 3, 1]
[8, 6, 7] [5, 0, 4] [2, 3, 1]	[4, 5, 8] [0, 7, 6] [2, 3, 1]
[8, 6, 7] [5, 4, 0] [2, 3, 1]	[4, 5, 8] [7, 0, 6] [2, 3, 1]
[8, 6, 0] [5, 4, 7] [2, 3, 1]	[4, 0, 8] [7, 5, 6] [2, 3, 1]
[8, 0, 6] [5, 4, 7] [2, 3, 1]	[0, 4, 8] [7, 5, 6] [2, 3, 1]
[0, 8, 6] [5, 4, 7] [2, 3, 1]	[7, 4, 8] [0, 5, 6] [2, 3, 1]
[5, 8, 6] [0, 4, 7] [2, 3, 1]	[7, 4, 8] [2, 5, 6] [0, 3, 1]
[5, 8, 6] [4, 0, 7] [2, 3, 1]	[7, 4, 8] [2, 5, 6] [3, 0, 1]
[5, 8, 6] [4, 7, 0] [2, 3, 1]	[7, 4, 8] [2, 5, 6] [3, 1, 0]

[7, 4, 8] [2, 5, 0] [3, 1, 6] [5, 0, 2] [3, 1, 6] [8, 7, 4]
[7, 4, 8] [2, 0, 5] [3, 1, 6] [0, 5, 2] [3, 1, 6] [8, 7, 4]
[7, 4, 8] [0, 2, 5] [3, 1, 6] [3, 5, 2] [0, 1, 6] [8, 7, 4]
[0, 4, 8] [7, 2, 5] [3, 1, 6] [3, 5, 2] [1, 0, 6] [8, 7, 4]
[4, 0, 8] [7, 2, 5] [3, 1, 6] [3, 0, 2] [1, 5, 6] [8, 7, 4]
[4, 8, 0] [7, 2, 5] [3, 1, 6] [3, 2, 0] [1, 5, 6] [8, 7, 4]
[4, 8, 5] [7, 2, 0] [3, 1, 6] [3, 2, 6] [1, 5, 0] [8, 7, 4]
[4, 8, 5] [7, 0, 2] [3, 1, 6] [3, 2, 6] [1, 5, 4] [8, 7, 0]
[4, 8, 5] [0, 7, 2] [3, 1, 6] [3, 2, 6] [1, 5, 4] [8, 0, 7]
[0, 8, 5] [4, 7, 2] [3, 1, 6] [3, 2, 6] [1, 5, 4] [0, 8, 7]
[8, 0, 5] [4, 7, 2] [3, 1, 6] [3, 2, 6] [0, 5, 4] [1, 8, 7]
[8, 5, 0] [4, 7, 2] [3, 1, 6] [0, 2, 6] [3, 5, 4] [1, 8, 7]
[8, 5, 2] [4, 7, 0] [3, 1, 6] [2, 0, 6] [3, 5, 4] [1, 8, 7]
[8, 5, 2] [4, 7, 6] [3, 1, 0] [2, 6, 0] [3, 5, 4] [1, 8, 7]
[8, 5, 2] [4, 7, 6] [3, 0, 1] [2, 6, 4] [3, 5, 0] [1, 8, 7]
[8, 5, 2] [4, 7, 6] [0, 3, 1] [2, 6, 4] [3, 5, 7] [1, 8, 0]
[8, 5, 2] [0, 7, 6] [4, 3, 1] [2, 6, 4] [3, 5, 7] [1, 0, 8]
[8, 5, 2] [7, 0, 6] [4, 3, 1] [2, 6, 4] [3, 5, 7] [0, 1, 8]
[8, 0, 2] [7, 5, 6] [4, 3, 1] [2, 6, 4] [0, 5, 7] [3, 1, 8]
[8, 2, 0] [7, 5, 6] [4, 3, 1] [2, 6, 4] [5, 0, 7] [3, 1, 8]
[8, 2, 6] [7, 5, 0] [4, 3, 1] [2, 6, 4] [5, 7, 0] [3, 1, 8]
[8, 2, 6] [7, 5, 1] [4, 3, 0] [2, 6, 0] [5, 7, 4] [3, 1, 8]
[8, 2, 6] [7, 5, 1] [4, 0, 3] [2, 0, 6] [5, 7, 4] [3, 1, 8]
[8, 2, 6] [7, 5, 1] [0, 4, 3] [0, 2, 6] [5, 7, 4] [3, 1, 8]
[8, 2, 6] [0, 5, 1] [7, 4, 3] [5, 2, 6] [0, 7, 4] [3, 1, 8]
[0, 2, 6] [8, 5, 1] [7, 4, 3] [5, 2, 6] [7, 0, 4] [3, 1, 8]
[2, 0, 6] [8, 5, 1] [7, 4, 3] [5, 2, 6] [7, 4, 0] [3, 1, 8]
[2, 6, 0] [8, 5, 1] [7, 4, 3] [5, 2, 0] [7, 4, 6] [3, 1, 8]
[2, 6, 1] [8, 5, 0] [7, 4, 3] [5, 0, 2] [7, 4, 6] [3, 1, 8]
[2, 6, 1] [8, 5, 3] [7, 4, 0] [0, 5, 2] [7, 4, 6] [3, 1, 8]
[2, 6, 1] [8, 5, 3] [7, 0, 4] [7, 5, 2] [0, 4, 6] [3, 1, 8]
[2, 6, 1] [8, 5, 3] [0, 7, 4] [7, 5, 2] [4, 0, 6] [3, 1, 8]
[2, 6, 1] [0, 5, 3] [8, 7, 4] [7, 0, 2] [4, 5, 6] [3, 1, 8]
[2, 6, 1] [5, 0, 3] [8, 7, 4] [7, 2, 0] [4, 5, 6] [3, 1, 8]
[2, 6, 1] [5, 3, 0] [8, 7, 4] [7, 2, 6] [4, 5, 0] [3, 1, 8]
[2, 6, 0] [5, 3, 1] [8, 7, 4] [7, 2, 6] [4, 5, 8] [3, 1, 0]
[2, 0, 6] [5, 3, 1] [8, 7, 4] [7, 2, 6] [4, 5, 8] [3, 0, 1]
[0, 2, 6] [5, 3, 1] [8, 7, 4] [7, 2, 6] [4, 5, 8] [0, 3, 1]
[5, 2, 6] [0, 3, 1] [8, 7, 4] [7, 2, 6] [0, 5, 8] [4, 3, 1]
[5, 2, 6] [3, 0, 1] [8, 7, 4] [0, 2, 6] [7, 5, 8] [4, 3, 1]
[5, 2, 6] [3, 1, 0] [8, 7, 4] [2, 0, 6] [7, 5, 8] [4, 3, 1]
[5, 2, 0] [3, 1, 6] [8, 7, 4] [2, 6, 0] [7, 5, 8] [4, 3, 1]

[2, 6, 8] [7, 5, 0] [4, 3, 1]   [6, 7, 4] [0, 5, 1] [2, 3, 8]
[2, 6, 8] [7, 0, 5] [4, 3, 1]   [6, 7, 4] [5, 0, 1] [2, 3, 8]
[2, 6, 8] [0, 7, 5] [4, 3, 1]   [6, 7, 4] [5, 1, 0] [2, 3, 8]
[0, 6, 8] [2, 7, 5] [4, 3, 1]   [6, 7, 0] [5, 1, 4] [2, 3, 8]
[6, 0, 8] [2, 7, 5] [4, 3, 1]   [6, 0, 7] [5, 1, 4] [2, 3, 8]
[6, 8, 0] [2, 7, 5] [4, 3, 1]   [0, 6, 7] [5, 1, 4] [2, 3, 8]
[6, 8, 5] [2, 7, 0] [4, 3, 1]   [5, 6, 7] [0, 1, 4] [2, 3, 8]
[6, 8, 5] [2, 0, 7] [4, 3, 1]   [5, 6, 7] [1, 0, 4] [2, 3, 8]
[6, 8, 5] [0, 2, 7] [4, 3, 1]   [5, 6, 7] [1, 4, 0] [2, 3, 8]
[0, 8, 5] [6, 2, 7] [4, 3, 1]   [5, 6, 0] [1, 4, 7] [2, 3, 8]
[8, 0, 5] [6, 2, 7] [4, 3, 1]   [5, 0, 6] [1, 4, 7] [2, 3, 8]
[8, 5, 0] [6, 2, 7] [4, 3, 1]   [0, 5, 6] [1, 4, 7] [2, 3, 8]
[8, 5, 7] [6, 2, 0] [4, 3, 1]   [1, 5, 6] [0, 4, 7] [2, 3, 8]
[8, 5, 7] [6, 0, 2] [4, 3, 1]   [1, 5, 6] [4, 0, 7] [2, 3, 8]
[8, 5, 7] [0, 6, 2] [4, 3, 1]   [1, 0, 6] [4, 5, 7] [2, 3, 8]
[0, 5, 7] [8, 6, 2] [4, 3, 1]   [1, 6, 0] [4, 5, 7] [2, 3, 8]
[5, 0, 7] [8, 6, 2] [4, 3, 1]   [1, 6, 7] [4, 5, 0] [2, 3, 8]
[5, 7, 0] [8, 6, 2] [4, 3, 1]   [1, 6, 7] [4, 5, 8] [2, 3, 0]
[5, 7, 2] [8, 6, 0] [4, 3, 1]   [1, 6, 7] [4, 5, 8] [2, 0, 3]
[5, 7, 2] [8, 0, 6] [4, 3, 1]   [1, 6, 7] [4, 5, 8] [0, 2, 3]
[5, 7, 2] [0, 8, 6] [4, 3, 1]   [1, 6, 7] [0, 5, 8] [4, 2, 3]
[5, 7, 2] [4, 8, 6] [0, 3, 1]   [1, 6, 7] [5, 0, 8] [4, 2, 3]
[5, 7, 2] [4, 8, 6] [3, 0, 1]   [1, 6, 7] [5, 8, 0] [4, 2, 3]
[5, 7, 2] [4, 0, 6] [3, 8, 1]   [1, 6, 0] [5, 8, 7] [4, 2, 3]
[5, 0, 2] [4, 7, 6] [3, 8, 1]   [1, 0, 6] [5, 8, 7] [4, 2, 3]
[5, 2, 0] [4, 7, 6] [3, 8, 1]   [0, 1, 6] [5, 8, 7] [4, 2, 3]
[5, 2, 6] [4, 7, 0] [3, 8, 1]   [5, 1, 6] [0, 8, 7] [4, 2, 3]
[5, 2, 6] [4, 0, 7] [3, 8, 1]   [5, 1, 6] [8, 0, 7] [4, 2, 3]
[5, 2, 6] [0, 4, 7] [3, 8, 1]   [5, 1, 6] [8, 7, 0] [4, 2, 3]
[0, 2, 6] [5, 4, 7] [3, 8, 1]   [5, 1, 0] [8, 7, 6] [4, 2, 3]
[2, 0, 6] [5, 4, 7] [3, 8, 1]   [5, 0, 1] [8, 7, 6] [4, 2, 3]
[2, 6, 0] [5, 4, 7] [3, 8, 1]   [0, 5, 1] [8, 7, 6] [4, 2, 3]
[2, 6, 7] [5, 4, 0] [3, 8, 1]   [8, 5, 1] [0, 7, 6] [4, 2, 3]
[2, 6, 7] [5, 0, 4] [3, 8, 1]   [8, 5, 1] [4, 7, 6] [0, 2, 3]
[2, 6, 7] [0, 5, 4] [3, 8, 1]   [8, 5, 1] [4, 7, 6] [2, 0, 3]
[0, 6, 7] [2, 5, 4] [3, 8, 1]   [8, 5, 1] [4, 7, 6] [2, 3, 0]
[6, 0, 7] [2, 5, 4] [3, 8, 1]   [8, 5, 1] [4, 7, 0] [2, 3, 6]
[6, 7, 0] [2, 5, 4] [3, 8, 1]   [8, 5, 1] [4, 0, 7] [2, 3, 6]
[6, 7, 4] [2, 5, 0] [3, 8, 1]   [8, 0, 1] [4, 5, 7] [2, 3, 6]
[6, 7, 4] [2, 5, 1] [3, 8, 0]   [0, 8, 1] [4, 5, 7] [2, 3, 6]
[6, 7, 4] [2, 5, 1] [3, 0, 8]   [4, 8, 1] [0, 5, 7] [2, 3, 6]
[6, 7, 4] [2, 5, 1] [0, 3, 8]   [4, 8, 1] [5, 0, 7] [2, 3, 6]

[4, 8, 1] [5, 7, 0] [2, 3, 6]   [1, 3, 6] [4, 5, 7] [8, 0, 2]
[4, 8, 0] [5, 7, 1] [2, 3, 6]   [1, 3, 6] [4, 5, 7] [8, 2, 0]
[4, 0, 8] [5, 7, 1] [2, 3, 6]   [1, 3, 6] [4, 5, 0] [8, 2, 7]
[0, 4, 8] [5, 7, 1] [2, 3, 6]   [1, 3, 0] [4, 5, 6] [8, 2, 7]
[5, 4, 8] [0, 7, 1] [2, 3, 6]   [1, 0, 3] [4, 5, 6] [8, 2, 7]
[5, 4, 8] [7, 0, 1] [2, 3, 6]   [0, 1, 3] [4, 5, 6] [8, 2, 7]
[5, 4, 8] [7, 1, 0] [2, 3, 6]   [4, 1, 3] [0, 5, 6] [8, 2, 7]
[5, 4, 0] [7, 1, 8] [2, 3, 6]   [4, 1, 3] [8, 5, 6] [0, 2, 7]
[5, 0, 4] [7, 1, 8] [2, 3, 6]   [4, 1, 3] [8, 5, 6] [2, 0, 7]
[0, 5, 4] [7, 1, 8] [2, 3, 6]   [4, 1, 3] [8, 5, 6] [2, 7, 0]
[7, 5, 4] [0, 1, 8] [2, 3, 6]   [4, 1, 3] [8, 5, 0] [2, 7, 6]
[7, 5, 4] [1, 0, 8] [2, 3, 6]   [4, 1, 3] [8, 0, 5] [2, 7, 6]
[7, 5, 4] [1, 8, 0] [2, 3, 6]   [4, 1, 3] [0, 8, 5] [2, 7, 6]
[7, 5, 0] [1, 8, 4] [2, 3, 6]   [0, 1, 3] [4, 8, 5] [2, 7, 6]
[7, 0, 5] [1, 8, 4] [2, 3, 6]   [1, 0, 3] [4, 8, 5] [2, 7, 6]
[0, 7, 5] [1, 8, 4] [2, 3, 6]   [1, 8, 3] [4, 0, 5] [2, 7, 6]
[1, 7, 5] [0, 8, 4] [2, 3, 6]   [1, 8, 3] [4, 5, 0] [2, 7, 6]
[1, 7, 5] [8, 0, 4] [2, 3, 6]   [1, 8, 3] [4, 5, 6] [2, 7, 0]
[1, 7, 5] [8, 4, 0] [2, 3, 6]   [1, 8, 3] [4, 5, 6] [2, 0, 7]
[1, 7, 5] [8, 4, 6] [2, 3, 0]   [1, 8, 3] [4, 5, 6] [0, 2, 7]
[1, 7, 5] [8, 4, 6] [2, 0, 3]   [1, 8, 3] [0, 5, 6] [4, 2, 7]
[1, 7, 5] [8, 4, 6] [0, 2, 3]   [1, 8, 3] [5, 0, 6] [4, 2, 7]
[1, 7, 5] [0, 4, 6] [8, 2, 3]   [1, 0, 3] [5, 8, 6] [4, 2, 7]
[1, 7, 5] [4, 0, 6] [8, 2, 3]   [0, 1, 3] [5, 8, 6] [4, 2, 7]
[1, 0, 5] [4, 7, 6] [8, 2, 3]   [5, 1, 3] [0, 8, 6] [4, 2, 7]
[1, 5, 0] [4, 7, 6] [8, 2, 3]   [5, 1, 3] [4, 8, 6] [0, 2, 7]
[1, 5, 6] [4, 7, 0] [8, 2, 3]   [5, 1, 3] [4, 8, 6] [2, 0, 7]
[1, 5, 6] [4, 0, 7] [8, 2, 3]   [5, 1, 3] [4, 0, 6] [2, 8, 7]
[1, 0, 6] [4, 5, 7] [8, 2, 3]   [5, 0, 3] [4, 1, 6] [2, 8, 7]
[1, 6, 0] [4, 5, 7] [8, 2, 3]   [0, 5, 3] [4, 1, 6] [2, 8, 7]
[1, 6, 7] [4, 5, 0] [8, 2, 3]   [4, 5, 3] [0, 1, 6] [2, 8, 7]
[1, 6, 7] [4, 5, 3] [8, 2, 0]   [4, 5, 3] [1, 0, 6] [2, 8, 7]
[1, 6, 7] [4, 5, 3] [8, 0, 2]   [4, 0, 3] [1, 5, 6] [2, 8, 7]
[1, 6, 7] [4, 5, 3] [0, 8, 2]   [0, 4, 3] [1, 5, 6] [2, 8, 7]
[1, 6, 7] [0, 5, 3] [4, 8, 2]   [1, 4, 3] [0, 5, 6] [2, 8, 7]
[1, 6, 7] [5, 0, 3] [4, 8, 2]   [1, 4, 3] [2, 5, 6] [0, 8, 7]
[1, 6, 7] [5, 3, 0] [4, 8, 2]   [1, 4, 3] [2, 5, 6] [8, 0, 7]
[1, 6, 0] [5, 3, 7] [4, 8, 2]   [1, 4, 3] [2, 5, 6] [8, 7, 0]
[1, 0, 6] [5, 3, 7] [4, 8, 2]   [1, 4, 3] [2, 5, 0] [8, 7, 6]
[1, 3, 6] [5, 0, 7] [4, 8, 2]   [1, 4, 3] [2, 0, 5] [8, 7, 6]
[1, 3, 6] [0, 5, 7] [4, 8, 2]   [1, 4, 3] [0, 2, 5] [8, 7, 6]
[1, 3, 6] [4, 5, 7] [0, 8, 2]   [1, 4, 3] [8, 2, 5] [0, 7, 6]

[1, 4, 3] [8, 2, 5] [7, 0, 6]   [1, 3, 6] [8, 5, 0] [4, 7, 2]
[1, 4, 3] [8, 2, 5] [7, 6, 0]   [1, 3, 6] [8, 5, 2] [4, 7, 0]
[1, 4, 3] [8, 2, 0] [7, 6, 5]   [1, 3, 6] [8, 5, 2] [4, 0, 7]
[1, 4, 3] [8, 0, 2] [7, 6, 5]   [1, 3, 6] [8, 5, 2] [0, 4, 7]
[1, 4, 3] [0, 8, 2] [7, 6, 5]   [1, 3, 6] [0, 5, 2] [8, 4, 7]
[0, 4, 3] [1, 8, 2] [7, 6, 5]   [1, 3, 6] [5, 0, 2] [8, 4, 7]
[4, 0, 3] [1, 8, 2] [7, 6, 5]   [1, 3, 6] [5, 2, 0] [8, 4, 7]
[4, 8, 3] [1, 0, 2] [7, 6, 5]   [1, 3, 0] [5, 2, 6] [8, 4, 7]
[4, 8, 3] [0, 1, 2] [7, 6, 5]   [1, 0, 3] [5, 2, 6] [8, 4, 7]
[0, 8, 3] [4, 1, 2] [7, 6, 5]   [1, 2, 3] [5, 0, 6] [8, 4, 7]
[8, 0, 3] [4, 1, 2] [7, 6, 5]   [1, 2, 3] [0, 5, 6] [8, 4, 7]
[8, 1, 3] [4, 0, 2] [7, 6, 5]   [1, 2, 3] [8, 5, 6] [0, 4, 7]
[8, 1, 3] [4, 2, 0] [7, 6, 5]   [1, 2, 3] [8, 5, 6] [4, 0, 7]
[8, 1, 3] [4, 2, 5] [7, 6, 0]   [1, 2, 3] [8, 5, 6] [4, 7, 0]
[8, 1, 3] [4, 2, 5] [7, 0, 6]   [1, 2, 3] [8, 5, 0] [4, 7, 6]
[8, 1, 3] [4, 0, 5] [7, 2, 6]   [1, 2, 3] [8, 0, 5] [4, 7, 6]
[8, 1, 3] [4, 5, 0] [7, 2, 6]   [1, 2, 3] [0, 8, 5] [4, 7, 6]
[8, 1, 3] [4, 5, 6] [7, 2, 0]   [1, 2, 3] [4, 8, 5] [0, 7, 6]
[8, 1, 3] [4, 5, 6] [7, 0, 2]   [1, 2, 3] [4, 8, 5] [7, 0, 6]
[8, 1, 3] [4, 5, 6] [0, 7, 2]   [1, 2, 3] [4, 0, 5] [7, 8, 6]
[8, 1, 3] [0, 5, 6] [4, 7, 2]   [1, 2, 3] [4, 5, 0] [7, 8, 6]
[0, 1, 3] [8, 5, 6] [4, 7, 2]   [1, 2, 3] [4, 5, 6] [7, 8, 0]
[1, 0, 3] [8, 5, 6] [4, 7, 2]
[1, 3, 0] [8, 5, 6] [4, 7, 2]

Custo do caminho: 319
Tempo total: 0.046080827713012695 s
Total de nós: 575
Total de nós explorados: 319

1.7 Greedy Best First Search Heuristic 2

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

********** Busca com Informação ***********

Greedy Best First Search Heuristic 2:
Resultados
Caminho: 0 1 4 6 7 8 10 12 13 14 16 18 19 20 22 24 25 26 28 30 31 32 34 36 37 38 40 42 43 44 46 47 51 53 54 55 57 60 62 63 65 67 68 69 71 72 74 77 79 80 82 84 85 86 88 89 91 94 96 97 99 101 102 103 105 106 108 111 113 114 116 118

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[4, 1, 3] [7, 5, 2] [6, 0, 8]
[8, 6, 7] [2, 5, 4] [0, 3, 1]	[4, 1, 3] [7, 5, 2] [0, 6, 8]
[8, 6, 7] [0, 5, 4] [2, 3, 1]	[4, 1, 3] [0, 5, 2] [7, 6, 8]
[0, 6, 7] [8, 5, 4] [2, 3, 1]	[0, 1, 3] [4, 5, 2] [7, 6, 8]
[6, 0, 7] [8, 5, 4] [2, 3, 1]	[1, 0, 3] [4, 5, 2] [7, 6, 8]
[6, 7, 0] [8, 5, 4] [2, 3, 1]	[1, 3, 0] [4, 5, 2] [7, 6, 8]
[6, 7, 4] [8, 5, 0] [2, 3, 1]	[1, 3, 2] [4, 5, 0] [7, 6, 8]
[6, 7, 4] [8, 5, 1] [2, 3, 0]	[1, 3, 2] [4, 0, 5] [7, 6, 8]
[6, 7, 4] [8, 5, 1] [2, 0, 3]	[1, 3, 2] [4, 6, 5] [7, 0, 8]
[6, 7, 4] [8, 5, 1] [0, 2, 3]	[1, 3, 2] [4, 6, 5] [7, 8, 0]
[6, 7, 4] [0, 5, 1] [8, 2, 3]	[1, 3, 2] [4, 6, 0] [7, 8, 5]
[0, 7, 4] [6, 5, 1] [8, 2, 3]	[1, 3, 2] [4, 0, 6] [7, 8, 5]
[7, 0, 4] [6, 5, 1] [8, 2, 3]	[1, 3, 2] [0, 4, 6] [7, 8, 5]
[7, 4, 0] [6, 5, 1] [8, 2, 3]	[0, 3, 2] [1, 4, 6] [7, 8, 5]
[7, 4, 1] [6, 5, 0] [8, 2, 3]	[3, 0, 2] [1, 4, 6] [7, 8, 5]
[7, 4, 1] [6, 5, 3] [8, 2, 0]	[3, 2, 0] [1, 4, 6] [7, 8, 5]
[7, 4, 1] [6, 5, 3] [8, 0, 2]	[3, 2, 6] [1, 4, 0] [7, 8, 5]
[7, 4, 1] [6, 5, 3] [0, 8, 2]	[3, 2, 6] [1, 4, 5] [7, 8, 0]
[7, 4, 1] [0, 5, 3] [6, 8, 2]	[3, 2, 6] [1, 4, 5] [7, 0, 8]
[0, 4, 1] [7, 5, 3] [6, 8, 2]	[3, 2, 6] [1, 4, 5] [0, 7, 8]
[4, 0, 1] [7, 5, 3] [6, 8, 2]	[3, 2, 6] [0, 4, 5] [1, 7, 8]
[4, 1, 0] [7, 5, 3] [6, 8, 2]	[3, 2, 6] [4, 0, 5] [1, 7, 8]
[4, 1, 3] [7, 5, 0] [6, 8, 2]	[3, 2, 6] [4, 5, 0] [1, 7, 8]
[4, 1, 3] [7, 5, 2] [6, 8, 0]	[3, 2, 0] [4, 5, 6] [1, 7, 8]

[3, 0, 2] [4, 5, 6] [1, 7, 8]   [3, 2, 5] [4, 1, 6] [7, 8, 0]
[0, 3, 2] [4, 5, 6] [1, 7, 8]   [3, 2, 5] [4, 1, 6] [7, 0, 8]
[4, 3, 2] [0, 5, 6] [1, 7, 8]   [3, 2, 5] [4, 1, 6] [0, 7, 8]
[4, 3, 2] [1, 5, 6] [0, 7, 8]   [3, 2, 5] [0, 1, 6] [4, 7, 8]
[4, 3, 2] [1, 5, 6] [7, 0, 8]   [3, 2, 5] [1, 0, 6] [4, 7, 8]
[4, 3, 2] [1, 5, 6] [7, 8, 0]   [3, 2, 5] [1, 6, 0] [4, 7, 8]
[4, 3, 2] [1, 5, 0] [7, 8, 6]   [3, 2, 0] [1, 6, 5] [4, 7, 8]
[4, 3, 2] [1, 0, 5] [7, 8, 6]   [3, 0, 2] [1, 6, 5] [4, 7, 8]
[4, 3, 2] [0, 1, 5] [7, 8, 6]   [0, 3, 2] [1, 6, 5] [4, 7, 8]
[0, 3, 2] [4, 1, 5] [7, 8, 6]   [1, 3, 2] [0, 6, 5] [4, 7, 8]
[3, 0, 2] [4, 1, 5] [7, 8, 6]   [1, 3, 2] [4, 6, 5] [0, 7, 8]
[3, 2, 0] [4, 1, 5] [7, 8, 6]
[3, 2, 5] [4, 1, 0] [7, 8, 6]

Custo do caminho: 71
Tempo total: 0.027896642684936523 s
Total de nós: 119
Total de nós explorados: 72

————————————————————

1.8 Hill Climbing Search Heuristic 1

Estado inicial = [8, 6, 7] [2, 5, 4] [3, 0, 1]

Estado objetivo = [1, 2, 3] [4, 5, 6] [7, 8, 0]

*************** Busca Local ***************

Hill Climbing Search Heuristic 1:
Resultados
Caminho: 0 3 5 9 15 24 51 94 152 246 407 639 1027 1642 3039 5472 8794 12988
19399 27932 42263 42264 42268 42280 42282 42285 42294 42302 42307 42318 42328
42344 42354 42366 42372 42383 42384 42385 42389 42391

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[1, 8, 6] [0, 4, 5] [7, 2, 3]
[8, 6, 7] [2, 0, 4] [3, 5, 1]	[1, 8, 6] [4, 0, 5] [7, 2, 3]
[8, 6, 7] [2, 4, 0] [3, 5, 1]	[1, 8, 6] [4, 2, 5] [7, 0, 3]
[8, 6, 0] [2, 4, 7] [3, 5, 1]	[1, 8, 6] [4, 2, 5] [7, 3, 0]
[8, 0, 6] [2, 4, 7] [3, 5, 1]	[1, 8, 6] [4, 2, 0] [7, 3, 5]
[8, 4, 6] [2, 0, 7] [3, 5, 1]	[1, 8, 6] [4, 0, 2] [7, 3, 5]
[8, 4, 6] [2, 7, 0] [3, 5, 1]	[1, 0, 6] [4, 8, 2] [7, 3, 5]
[8, 4, 6] [2, 7, 1] [3, 5, 0]	[1, 6, 0] [4, 8, 2] [7, 3, 5]
[8, 4, 6] [2, 7, 1] [3, 0, 5]	[1, 6, 2] [4, 8, 0] [7, 3, 5]
[8, 4, 6] [2, 7, 1] [0, 3, 5]	[1, 6, 2] [4, 0, 8] [7, 3, 5]
[8, 4, 6] [0, 7, 1] [2, 3, 5]	[1, 6, 2] [4, 3, 8] [7, 0, 5]
[8, 4, 6] [7, 0, 1] [2, 3, 5]	[1, 6, 2] [4, 3, 8] [7, 5, 0]
[8, 4, 6] [7, 1, 0] [2, 3, 5]	[1, 6, 2] [4, 3, 0] [7, 5, 8]
[8, 4, 6] [7, 1, 5] [2, 3, 0]	[1, 6, 2] [4, 0, 3] [7, 5, 8]
[8, 4, 6] [7, 1, 5] [2, 0, 3]	[1, 0, 2] [4, 6, 3] [7, 5, 8]
[8, 4, 6] [7, 1, 5] [0, 2, 3]	[1, 2, 0] [4, 6, 3] [7, 5, 8]
[8, 4, 6] [0, 1, 5] [7, 2, 3]	[1, 2, 3] [4, 6, 0] [7, 5, 8]
[8, 4, 6] [1, 0, 5] [7, 2, 3]	[1, 2, 3] [4, 0, 6] [7, 5, 8]
[8, 0, 6] [1, 4, 5] [7, 2, 3]	[1, 2, 3] [4, 5, 6] [7, 0, 8]
[0, 8, 6] [1, 4, 5] [7, 2, 3]	[1, 2, 3] [4, 5, 6] [7, 8, 0]

Custo do caminho: 39
Tempo total: 73.35269522666931 s
Total de nós: 42392
Total de nós explorados: 27196

1.9 Hill Climbing Search Heuristic 2

Estado inicial
[8, 6, 7] [2, 5, 4] [3, 0, 1]

───────────────────────────────

Estado objetivo
[1, 2, 3] [4, 5, 6] [7, 8, 0]

───────────────────────────────

*************** Busca Local ***************

───────────────────────────────

Hill Climbing Search Heuristic 2:
Resultados
Caminho: 0 3 6 39 44 46 93 94 96 97 150 188 190 192 237 238 240 260 261 262 264 266 316 317 319 321 322 323 325 327 361 363 365 369 370 371 373 375 376 377 379 381 382 383

[8, 6, 7] [2, 5, 4] [3, 0, 1]	[6, 0, 8] [2, 3, 7] [5, 1, 4]
[8, 6, 7] [2, 0, 4] [3, 5, 1]	[0, 6, 8] [2, 3, 7] [5, 1, 4]
[8, 0, 7] [2, 6, 4] [3, 5, 1]	[2, 6, 8] [0, 3, 7] [5, 1, 4]
[8, 7, 0] [2, 6, 4] [3, 5, 1]	[2, 6, 8] [5, 3, 7] [0, 1, 4]
[8, 7, 4] [2, 6, 0] [3, 5, 1]	[2, 6, 8] [5, 3, 7] [1, 0, 4]
[8, 7, 4] [2, 6, 1] [3, 5, 0]	[2, 6, 8] [5, 3, 7] [1, 4, 0]
[8, 7, 4] [2, 6, 1] [3, 0, 5]	[2, 6, 8] [5, 3, 0] [1, 4, 7]
[8, 7, 4] [2, 6, 1] [0, 3, 5]	[2, 6, 0] [5, 3, 8] [1, 4, 7]
[8, 7, 4] [0, 6, 1] [2, 3, 5]	[2, 0, 6] [5, 3, 8] [1, 4, 7]
[8, 7, 4] [6, 0, 1] [2, 3, 5]	[2, 3, 6] [5, 0, 8] [1, 4, 7]
[8, 7, 4] [6, 3, 1] [2, 0, 5]	[2, 3, 6] [0, 5, 8] [1, 4, 7]
[8, 7, 4] [6, 3, 1] [2, 5, 0]	[2, 3, 6] [1, 5, 8] [0, 4, 7]
[8, 7, 4] [6, 3, 0] [2, 5, 1]	[2, 3, 6] [1, 5, 8] [4, 0, 7]
[8, 7, 0] [6, 3, 4] [2, 5, 1]	[2, 3, 6] [1, 5, 8] [4, 7, 0]
[8, 0, 7] [6, 3, 4] [2, 5, 1]	[2, 3, 6] [1, 5, 0] [4, 7, 8]
[0, 8, 7] [6, 3, 4] [2, 5, 1]	[2, 3, 0] [1, 5, 6] [4, 7, 8]
[6, 8, 7] [0, 3, 4] [2, 5, 1]	[2, 0, 3] [1, 5, 6] [4, 7, 8]
[6, 8, 7] [2, 3, 4] [0, 5, 1]	[0, 2, 3] [1, 5, 6] [4, 7, 8]
[6, 8, 7] [2, 3, 4] [5, 0, 1]	[1, 2, 3] [0, 5, 6] [4, 7, 8]
[6, 8, 7] [2, 3, 4] [5, 1, 0]	[1, 2, 3] [4, 5, 6] [0, 7, 8]
[6, 8, 7] [2, 3, 0] [5, 1, 4]	[1, 2, 3] [4, 5, 6] [7, 0, 8]
[6, 8, 0] [2, 3, 7] [5, 1, 4]	[1, 2, 3] [4, 5, 6] [7, 8, 0]

Custo do caminho: 43
Tempo total: 0.05461835861206055 s
Total de nós: 385
Total de nós explorados: 246