

# Solução do Problema scorpion - Solver HiGHS

Análise Computacional

16 de setembro de 2025

## 1 Informações do Problema

### Informações do Problema:

- Nome: scorpion
- Número de Variáveis: 358
- Número de Restrições: 388
- Inviabilidade Primal: 0.000e+00
- Inviabilidade Dual: 0.000e+00
- Valor Primal: 1.878e+03
- Valor Dual: 1.878e+03
- Gap: 9.666e-20
- Número de Iterações: 11

## 2 Variáveis Primais e Custos Reduzidos

Tabela 1: Variáveis primais e custos reduzidos do problema scorpion

Coordenada x	Valor x	Coordenada z	Valor z
1	0.008500	1	0.000000
2	0.002000	2	0.000000
3	-0.000000	3	0.000000
4	-0.000000	4	0.000000
5	1.445907	5	0.000000
6	-0.000000	6	0.000000
7	0.000148	7	0.000000
8	0.003948	8	0.000000
9	0.001036	9	0.000000
10	0.004738	10	0.000000
11	-0.000000	11	0.000000
12	0.000000	12	3.107306

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Coordenada x	Valor x	Coordenada z	Valor z
13	-0.000000	13	0.000000
14	-0.000000	14	0.000000
15	0.020387	15	0.000000
16	0.475703	16	0.000000
17	0.237852	17	0.000000
18	0.625210	18	0.000000
19	-0.000000	19	0.000000
20	0.000000	20	47.533728
21	-0.000000	21	0.000000
22	-0.000000	22	0.000000
23	0.380714	23	0.000000
24	-0.000000	24	0.000000
25	0.249234	25	0.000000
26	0.084100	26	0.000000
27	0.042945	27	0.000000
28	0.116308	28	0.000000
29	0.114519	29	0.000000
30	-0.000000	30	0.000000
31	-0.000000	31	0.000000
32	-0.000000	32	0.000000
33	0.000000	33	149.388116
34	0.000000	34	118.676666
35	0.130000	35	0.000000
36	0.200000	36	0.000000
37	0.590000	37	0.000000
38	0.349873	38	0.000000
39	0.070000	39	0.000000
40	0.120000	40	0.000000
41	0.400000	41	0.000000
42	0.250000	42	0.000000
43	0.130000	43	0.000000
44	0.150000	44	0.000000
45	0.050000	45	0.000000
46	0.063480	46	0.000000
47	0.070000	47	0.000000
48	0.120000	48	0.000000
49	0.400000	49	0.000000
50	0.250000	50	0.000000
51	0.099873	51	0.000000
52	0.006348	52	0.000000
53	-0.000000	53	0.000000
54	-0.000000	54	0.000000
55	0.367899	55	0.000000
56	0.013060	56	0.000000
57	0.007000	57	0.000000
58	0.006000	58	0.000000
59	-0.000000	59	0.000000
60	-0.000000	60	0.000000
61	1.526123	61	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
62	-0.000000	62	0.000000
63	0.000183	63	0.000000
64	0.004888	64	0.000000
65	0.001283	65	0.000000
66	0.005866	66	0.000000
67	-0.000000	67	0.000000
68	-0.000000	68	0.000000
69	0.000000	69	6.910514
70	-0.000000	70	0.000000
71	0.021518	71	0.000000
72	0.502095	72	0.000000
73	0.251047	73	0.000000
74	0.659896	74	0.000000
75	-0.000000	75	0.000000
76	-0.000000	76	0.000000
77	-0.000000	77	0.000000
78	-0.000000	78	0.000000
79	0.420200	79	0.000000
80	-0.000000	80	0.000000
81	0.245562	81	0.000000
82	0.092822	82	0.000000
83	0.047399	83	0.000000
84	0.128371	84	0.000000
85	0.126396	85	0.000000
86	-0.000000	86	0.000000
87	-0.000000	87	0.000000
88	-0.000000	88	0.000000
89	0.000000	89	147.467561
90	0.000000	90	118.006899
91	0.120000	91	0.000000
92	0.215000	92	0.000000
93	0.629000	93	0.000000
94	0.374939	94	0.000000
95	0.080000	95	0.000000
96	0.129000	96	0.000000
97	0.420000	97	0.000000
98	0.290000	98	0.000000
99	0.120000	99	0.000000
100	0.160000	100	0.000000
101	0.055000	101	0.000000
102	0.069100	102	0.000000
103	0.080000	103	0.000000
104	0.129000	104	0.000000
105	0.420000	105	0.000000
106	0.290000	106	0.000000
107	0.084939	107	0.000000
108	0.000562	108	0.000000
109	-0.000000	109	0.000000
110	0.000000	110	104.990000

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Coordenada x	Valor x	Coordenada z	Valor z
111	0.072453	111	0.000000
112	0.307070	112	0.000000
113	0.006348	113	0.000000
114	0.000000	114	50.890000
115	0.000000	115	152.970000
116	0.367899	116	0.000000
117	0.013060	117	0.000000
118	0.002000	118	0.000000
119	0.018000	119	0.000000
120	-0.000000	120	0.000000
121	0.140108	121	0.000000
122	1.456293	122	0.000000
123	-0.000000	123	0.000000
124	0.000282	124	0.000000
125	0.007520	125	0.000000
126	0.001974	126	0.000000
127	0.009024	127	0.000000
128	0.002634	128	0.000000
129	0.051363	129	0.000000
130	0.026340	130	0.000000
131	0.051363	131	0.000000
132	0.020534	132	0.000000
133	0.479120	133	0.000000
134	0.239560	134	0.000000
135	0.629701	135	0.000000
136	-0.000000	136	0.000000
137	0.000000	137	14.017272
138	-0.000000	138	0.000000
139	-0.000000	139	0.000000
140	0.509766	140	0.000000
141	-0.000000	141	0.000000
142	0.180322	142	0.000000
143	0.112607	143	0.000000
144	0.057502	144	0.000000
145	0.155734	145	0.000000
146	0.153338	146	0.000000
147	-0.000000	147	0.000000
148	-0.000000	148	0.000000
149	-0.000000	149	0.000000
150	0.000000	150	79.083293
151	0.000000	151	99.239390
152	0.050000	152	0.000000
153	0.240000	153	0.000000
154	0.686800	154	0.000000
155	0.417000	155	0.000000
156	0.090000	156	0.000000
157	0.146800	157	0.000000
158	0.450000	158	0.000000
159	0.330000	159	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
160	0.050000	160	0.000000
161	0.180000	161	0.000000
162	0.060000	162	0.000000
163	0.080951	163	0.000000
164	0.090000	164	0.000000
165	0.146800	165	0.000000
166	0.450000	166	0.000000
167	0.330000	167	0.000000
168	0.087000	168	0.000000
169	0.001185	169	0.000000
170	0.000000	170	14.120000
171	0.000000	171	64.810000
172	0.129373	172	0.000000
173	0.481345	173	0.000000
174	0.006348	174	0.000000
175	0.000562	175	0.000000
176	-0.000000	176	0.000000
177	0.000000	177	30.730000
178	-0.000000	178	0.000000
179	-0.000000	179	0.000000
180	0.367899	180	0.000000
181	0.072453	181	0.000000
182	0.013060	182	0.000000
183	0.307070	183	0.000000
184	-0.000000	184	0.000000
185	0.030000	185	0.000000
186	-0.000000	186	0.000000
187	-0.000000	187	0.000000
188	1.822208	188	0.000000
189	-0.000000	189	0.000000
190	0.000423	190	0.000000
191	0.011280	191	0.000000
192	0.002961	192	0.000000
193	0.013536	193	0.000000
194	-0.000000	194	0.000000
195	0.000000	195	12.679705
196	-0.000000	196	0.000000
197	-0.000000	197	0.000000
198	0.025693	198	0.000000
199	0.599506	199	0.000000
200	0.299753	200	0.000000
201	0.787923	201	0.000000
202	-0.000000	202	0.000000
203	0.000000	203	34.950844
204	-0.000000	204	0.000000
205	-0.000000	205	0.000000
206	0.540004	206	0.000000
207	0.072661	207	0.000000
208	0.188794	208	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
209	0.119287	209	0.000000
210	0.060912	210	0.000000
211	0.164971	211	0.000000
212	0.162433	212	0.000000
213	-0.000000	213	0.000000
214	0.008196	214	0.000000
215	-0.000000	215	0.000000
216	0.060105	216	0.000000
217	0.000000	217	157.037564
218	0.040000	218	0.000000
219	0.265000	219	0.000000
220	0.768000	220	0.000000
221	0.520000	221	0.000000
222	0.100000	222	0.000000
223	0.168000	223	0.000000
224	0.500000	224	0.000000
225	0.410000	225	0.000000
226	0.040000	226	0.000000
227	0.200000	227	0.000000
228	0.065000	228	0.000000
229	0.095225	229	0.000000
230	0.100000	230	0.000000
231	0.168000	231	0.000000
232	0.500000	232	0.000000
233	0.410000	233	0.000000
234	0.110000	234	0.000000
235	0.001427	235	0.000000
236	0.202273	236	0.000000
237	0.081484	237	0.000000
238	0.065573	238	0.000000
239	1.048218	239	0.000000
240	0.006348	240	0.000000
241	0.000562	241	0.000000
242	0.001185	242	0.000000
243	-0.000000	243	0.000000
244	-0.000000	244	0.000000
245	-0.000000	245	0.000000
246	0.481345	246	0.000000
247	-0.000000	247	0.000000
248	0.010000	248	0.000000
249	-0.000000	249	0.000000
250	-0.000000	250	0.000000
251	2.168580	251	0.000000
252	-0.000000	252	0.000000
253	0.000141	253	0.000000
254	0.003760	254	0.000000
255	0.000987	255	0.000000
256	0.004512	256	0.000000
257	-0.000000	257	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
258	-0.000000	258	0.000000
259	0.000000	259	20.399774
260	-0.000000	260	0.000000
261	0.030577	261	0.000000
262	0.713463	262	0.000000
263	0.356731	263	0.000000
264	0.937694	264	0.000000
265	-0.000000	265	0.000000
266	0.000000	266	32.945616
267	-0.000000	267	0.000000
268	-0.000000	268	0.000000
269	0.644578	269	0.000000
270	0.126884	270	0.000000
271	0.170744	271	0.000000
272	0.142387	272	0.000000
273	0.072708	273	0.000000
274	0.196919	274	0.000000
275	0.193889	275	0.000000
276	-0.000000	276	0.000000
277	0.014312	277	0.000000
278	-0.000000	278	0.000000
279	0.104958	279	0.000000
280	0.000000	280	133.081208
281	0.040000	281	0.000000
282	0.270000	282	0.000000
283	0.905000	283	0.000000
284	0.650000	284	0.000000
285	0.110000	285	0.000000
286	0.245000	286	0.000000
287	0.550000	287	0.000000
288	0.500000	288	0.000000
289	0.040000	289	0.000000
290	0.200000	290	0.000000
291	0.070000	291	0.000000
292	0.117739	292	0.000000
293	0.110000	293	0.000000
294	0.245000	294	0.000000
295	0.550000	295	0.000000
296	0.500000	296	0.000000
297	0.150000	297	0.000000
298	0.002251	298	0.000000
299	0.268687	299	0.000000
300	0.067791	300	0.000000
301	0.692754	301	0.000000
302	0.763679	302	0.000000
303	-0.000000	303	0.000000
304	-0.000000	304	0.000000
305	-0.000000	305	0.000000
306	-0.000000	306	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
307	2.543326	307	0.000000
308	-0.000000	308	0.000000
309	0.000000	309	60.599627
310	-0.000000	310	0.000000
311	0.000000	311	1.822190
312	0.000000	312	23.954769
313	-0.000000	313	0.000000
314	-0.000000	314	0.000000
315	0.000000	315	5.326680
316	-0.000000	316	0.000000
317	0.035861	317	0.000000
318	0.836754	318	0.000000
319	0.418377	319	0.000000
320	1.099734	320	0.000000
321	-0.000000	321	0.000000
322	0.000000	322	10.942093
323	-0.000000	323	0.000000
324	-0.000000	324	0.000000
325	0.597177	325	0.000000
326	0.351645	326	0.000000
327	0.150912	327	0.000000
328	0.131916	328	0.000000
329	0.067362	329	0.000000
330	0.182438	330	0.000000
331	0.179631	331	0.000000
332	-0.000000	332	0.000000
333	0.039666	333	0.000000
334	-0.000000	334	0.000000
335	0.290881	335	0.000000
336	0.000000	336	36.902381
337	0.000000	337	37.192381
338	0.280000	338	0.000000
339	1.009000	339	0.000000
340	0.880000	340	0.000000
341	0.120000	341	0.000000
342	0.289000	342	0.000000
343	0.600000	343	0.000000
344	0.680000	344	0.000000
345	-0.000000	345	0.000000
346	0.200000	346	0.000000
347	0.080000	347	0.000000
348	0.142888	348	0.000000
349	0.120000	349	0.000000
350	0.289000	350	0.000000
351	0.600000	351	0.000000
352	0.680000	352	0.000000
353	0.200000	353	0.000000
354	0.012037	354	0.000000
355	0.279040	355	0.000000

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Coordenada x	Valor x	Coordenada z	Valor z
356	0.551600	356	0.000000
357	0.936749	357	0.000000
358	2.677185	358	0.000000

### 3 Variáveis Duais (Multiplicadores de Lagrange)

Tabela 2: Variáveis duais do problema scorpion

Coordenada y	Valor y
1	-0.000000
2	120.946666
3	123.216666
4	123.216666
5	-0.000000
6	441.194026
7	493.344026
8	462.274026
9	56.690000
10	-0.000000
11	-150.785516
12	-433.684885
13	-0.000000
14	-123.381899
15	432.287485
16	-0.000000
17	433.684885
18	310.302986
19	-123.381899
20	-1.397400
21	-481.218614
22	-0.000000
23	-123.381899
24	-1.397400
25	-433.684885
26	-0.000000
27	-123.381899
28	-1.397400
29	-436.792191
30	-0.000000
31	-0.000000
32	121.984499
33	-310.302986
34	123.381899
35	-0.000000
36	-54.420000
37	-0.000000

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Coordenada y	Valor y
38	-36.282353
39	-9.821053
40	-0.000000
41	-436.654026
42	-436.654026
43	-436.654026
44	4.540000
45	-432.114026
46	-118.676666
47	-118.676666
48	0.450000
49	-117.489899
50	-118.676666
51	-124.989254
52	4.540000
53	-432.114026
54	-163.587502
55	-192.703247
56	-202.447928
57	-212.405375
58	-226.501993
59	-203.090820
60	-100.820820
61	-182.450820
62	12.930000
63	62.030000
64	184.650000
65	101.710000
66	74.450000
67	-0.000000
68	119.936899
69	121.866899
70	121.866899
71	-0.000000
72	417.153021
73	461.553021
74	435.103021
75	48.260000
76	-0.000000
77	-148.519161
78	-410.211691
79	-0.000000
80	-121.699830
81	409.160091
82	-0.000000
83	410.211691
84	288.511861
85	-39.066059
86	81.582171

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Coordenada y	Valor y
87	-327.577920
88	82.633771
89	-0.000000
90	120.648230
91	-288.511861
92	121.699830
93	-0.000000
94	113.737716
95	-288.511861
96	121.699830
97	-0.000000
98	120.648230
99	-288.511861
100	121.699830
101	-0.000000
102	-44.830000
103	-0.000000
104	-30.388235
105	-14.368421
106	-0.000000
107	-413.293021
108	-413.293021
109	-413.293021
110	3.860000
111	-409.433021
112	-118.006899
113	-118.006899
114	0.390000
115	-116.826830
116	-118.006899
117	-124.283862
118	3.860000
119	-409.433021
120	-156.611772
121	-185.562150
122	-194.477044
123	-203.774916
124	-217.348013
125	-189.938711
126	-102.888711
127	-172.368711
128	6.160000
129	6.160000
130	20.370000
131	20.370000
132	31.680000
133	31.680000
134	63.600000
135	63.600000

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Coordenada y	Valor y
136	23.560000
137	54.290000
138	-0.000000
139	100.949390
140	102.649390
141	102.649390
142	-0.000000
143	384.046825
144	423.266825
145	399.906825
146	88.260962
147	45.630962
148	-125.033046
149	-377.605557
150	-0.000000
151	-102.397996
152	331.655804
153	-0.000000
154	377.605557
155	275.207561
156	-0.000000
157	56.448243
158	-289.224833
159	102.397996
160	-102.397996
161	-45.949753
162	-377.605557
163	-0.000000
164	-102.397996
165	-45.949753
166	-377.605557
167	-0.000000
168	-102.397996
169	-45.949753
170	-377.605557
171	-0.000000
172	-0.000000
173	-38.110000
174	-0.000000
175	-49.011765
176	-7.126316
177	-45.630962
178	-380.636825
179	-380.636825
180	-380.636825
181	-42.220962
182	-377.226825
183	-99.239390
184	-99.239390

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Coordenada y	Valor y
185	0.340000
186	-98.246996
187	-99.239390
188	-104.518081
189	-42.220962
190	-377.226825
191	-156.658256
192	-174.070549
193	-182.815230
194	-191.900336
195	-200.526985
196	-181.369050
197	-104.459050
198	-165.849050
199	5.830000
200	22.850000
201	22.850000
202	22.850000
203	8.460000
204	8.460000
205	8.460000
206	-0.000000
207	158.637564
208	160.227564
209	160.227564
210	-0.000000
211	254.581059
212	291.321059
213	269.441059
214	279.751808
215	239.821808
216	-234.885490
217	-246.339049
218	-0.000000
219	-156.087189
220	11.453559
221	-0.000000
222	246.339049
223	90.251860
224	-0.000000
225	-78.798301
226	-125.202704
227	156.087189
228	-0.000000
229	-78.798301
230	-90.251860
231	156.087189
232	-0.000000
233	-78.798301

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Coordenada y	Valor y
234	-102.931565
235	156.087189
236	-156.087189
237	-234.885490
238	-246.339049
239	-0.000000
240	-15.100000
241	-40.750000
242	-37.270588
243	-23.964706
244	-6.484211
245	-239.821808
246	-251.391059
247	-251.391059
248	-251.391059
249	-236.631808
250	-248.201059
251	-157.037564
252	-157.037564
253	0.320000
254	-151.692189
255	-157.037564
256	-201.024231
257	-236.631808
258	-248.201059
259	-186.869037
260	-184.876820
261	-194.408735
262	-204.153415
263	-193.405447
264	-175.316909
265	-103.276909
266	-160.776909
267	-0.000000
268	134.271208
269	135.451208
270	135.451208
271	-0.000000
272	218.516567
273	245.796567
274	229.546567
275	236.977086
276	207.327086
277	-203.317516
278	-212.048801
279	-0.000000
280	-132.160396
281	8.731286
282	-0.000000

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Coordenada y	Valor y
283	212.048801
284	79.888405
285	-0.000000
286	-71.157120
287	-112.834021
288	132.160396
289	-0.000000
290	-71.157120
291	-79.888405
292	132.160396
293	-0.000000
294	-91.556894
295	-79.888405
296	132.160396
297	-0.000000
298	-71.157120
299	-79.888405
300	132.160396
301	-8.460000
302	-22.850000
303	-35.282353
304	-22.682353
305	-6.136842
306	-207.327086
307	-216.146567
308	-216.146567
309	-216.146567
310	-204.957086
311	-213.776567
312	-133.081208
313	-133.081208
314	0.240000
315	-129.635396
316	-133.081208
317	-175.444414
318	-204.957086
319	-213.776567
320	-162.040158
321	-159.677492
322	-167.826428
323	-176.220045
324	-166.839850
325	-150.692617
326	-97.212617
327	-139.902617
328	-0.000000
329	-0.000000
330	37.492381
331	37.492381

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Coordenada y	Valor y
332	-0.000000
333	62.279118
334	69.059118
335	65.019118
336	67.218522
337	59.848522
338	-58.777437
339	-60.599627
340	-0.000000
341	-36.644858
342	1.822190
343	-0.000000
344	60.599627
345	23.954769
346	-0.000000
347	-22.132580
348	-34.896862
349	36.644858
350	-0.000000
351	-22.132580
352	-23.954769
353	36.644858
354	-0.000000
355	-27.459260
356	-23.954769
357	36.644858
358	-0.000000
359	-0.000000
360	-0.000000
361	-0.000000
362	-2.610000
363	-7.040000
364	-11.796078
365	-7.576471
366	-1.536842
367	-59.848522
368	-61.689118
369	-61.689118
370	-61.689118
371	-59.258522
372	-61.099118
373	-36.902381
374	0.290000
375	0.060000
376	-35.880858
377	-36.902381
378	-50.720145
379	-59.258522
380	-61.099118
Continua na próxima página	



Coordenada y	Valor y
381	-46.231200
382	-45.230683
383	-47.528555
384	-49.922172
385	-59.775627
386	-54.652247
387	-41.352247
388	-51.972247

## 4 Observações

- O solver HiGHS foi configurado com o método IPM (Interior Point Method).
- Este arquivo contém a solução detalhada para o problema scorpion.
- As variáveis duais representam os multiplicadores de Lagrange das restrições.
- Os custos reduzidos (z) indicam o impacto de forçar variáveis não-básicas na base.