Heuristic Analysis

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1 INTRODUCTION

The heuristic analysis consisted on running the air cargo problem sets with the following search algorithms:

1. `breadth_first_search`
2. `breadth_first_tree_search`
3. `depth_first_graph_search`
4. `depth_limited_search`
5. `uniform_cost_search`
6. `recursive_best_first_search h_1`
7. `greedy_best_first_graph_search h_1`
8. `astar_search h_1`
9. `astar_search h_ignore_preconditions`
10. `astar_search h_pg_levelsum`

Here we considered:

- How much the goal test was achieved
- Runtime
- How much resource was consumed

2 ANALYSIS

The best solution (considering how much the goal tests was achieved, shortest path length) were produced by A* algorithm variants. However they had the longest runtime (on big problem sets) and drained more computational resources. If these are the choice criteria, the best option is **astar_search h_ignore_preconditions** due its shortest runtime among the A* results.

If the computational cost (number of internal nodes) and runtime are constraints, but optimal solutions are acceptable, we may use the **depth_first_graph_search**. This solutions are much faster than A* variants, however they may produce longer path lengths.

3 PROBLEM DATA SETS

3.1 Problem 1

Algorithm	Expansions	Goal test	New nodes	Plan length	Runtime (s)
breadth_first_search	43	56	180	6	0,02022
breadth_first_tree_search	1458	1459	5960	6	0,56841
depth_first_graph_search	12	13	48	12	0,00492
depth_limited_search	101	271	414	50	0,05174
uniform_cost_search	55	57	224	6	0,02103
recursive_best_first_search h_1	4229	4230	17029	6	1,70729
greedy_best_first_graph_search h_1	7	9	28	6	0,00293
astar_search h_1	55	57	224	6	0,02190
astar_search h_ignore_preconditions	41	43	170	6	0,02249
astar_search h_pg_levelsum	11	13	50	6	0,41280

3.2 Problem 2

Algorithm	Expansions	Goal test	New nodes	Plan length	Runtime (s)
breadth_first_search	3343	4609	30509	9	5,27376
breadth_first_tree_search	-	-	-	-	∞
depth_first_graph_search	582	583	5211	575	1,90168
depth_limited_search	-	-	-	-	∞
uniform_cost_search	4852	4854	44030	9	7,76136
recursive_best_first_search h_1	-	-	-	-	∞
greedy_best_first_graph_search h_1	990	992	8910	15	1,64463
astar_search h_1	4852	4854	44030	9	7,84574
astar_search h_ignore_preconditions	1450	1452	13303	9	2,87178
astar_search h_pg_levelsum	86	88	841	9	39,9887

3.3 Problem 3

Algorithm	Expansions	Goal test	New nodes	Plan length	Runtime (s)
breadth_first_search	14663	18098	129631	12	46,69717
breadth_first_tree_search	-	-	-	-	∞
depth_first_graph_search	627	628	5176	596	1,92429
depth_limited_search	-	-	-	-	∞
uniform_cost_search	18235	18237	159716	12	34,17854
recursive_best_first_search h_1	-	-	-	-	∞
greedy_best_first_graph_search h_1	5614	5616	49429	22	10,74799
astar_search h_1	18235	18237	159716	12	34,83502
astar_search h_ignore_preconditions	5040	5042	44944	12	11,20433
astar_search h_pg_levelsum	325	327	3002	12	200,92419