**Heuristic Analysis**

**Air Cargo Problem 1 -**

|  |  |  |  |
| --- | --- | --- | --- |
| Search | Expansions | Goal Tests | Time Elapsed |
| Breadth First Search | 43 | 56 | 0.0307 |
| Breadth First Tree Search | 1458 | 1459 | 0.8700 |
| Depth First Graph Search | 21 | 22 | 0.0133 |
| Depth Limited Search | 101 | 271 | 0.0818 |
| Uniform Cost Search | 55 | 57 | 0.0357 |
| Recursive Best First Search with H\_1 | 4229 | 4230 | 2.6739 |
| Greedy Best First Graph Search with H\_1 | 7 | 9 | 0.0048 |
| A\* Search with H\_1 | 55 | 57 | 0.0367 |
| A\* Search with H\_Ignore\_Preconditions | 41 | 43 | 0.0420 |
| A\* Search with H\_PG\_Levelsum | 11 | 13 | 2.3389 |

* Optimal plan:

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P1, SFO, JFK)

Fly(P2, JFK, SFO)

Unload(C1, P1, JFK)

Unload(C2, P2, SFO)

* Compare and contrast non-heuristic search result metrics:
* Compare and contrast heuristic search result metrics using A\* with the "ignore preconditions" and "level-sum" heuristics:
* What was the best heuristic used in these problems? Was it better than non-heuristic search planning methods for all problems? Why or why not?

**Air Cargo Problem 2 -**

|  |  |  |  |
| --- | --- | --- | --- |
| Search | Expansions | Goal Tests | Time Elapsed |
| Breadth First Search | 3343 | 4609 | 12.7710 |
| Depth First Graph Search | 624 | 625 | 3.2286 |
| Depth Limited Search | 222719 | 2053741 | 775.303 |
| Uniform Cost Search | 4853 | 4855 | 41.6690 |
| Greedy Best First Graph Search with H\_1 | 998 | 1000 | 6.7765 |
| A\* Search with H\_1 | 4853 | 4855 | 41.9427 |
| A\* Search with H\_Ignore\_Preconditions | 1506 | 1508 | 13.3721 |
| A\* Search with H\_PG\_Levelsum | 86 | 88 | 259.7987 |

* Optimal plan:

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Load(C3, P3, ATL)

Fly(P1, SFO, JFK)

Fly(P2, JFK, SFO)

Fly(P3, ATL, SFO)

Unload(C1, P1, JFK)

Unload(C2, P2, SFO)

Unload(C3, P3, SFO)

* Compare and contrast non-heuristic search result metrics:
* Compare and contrast heuristic search result metrics using A\* with the "ignore preconditions" and "level-sum" heuristics:
* What was the best heuristic used in these problems? Was it better than non-heuristic search planning methods for all problems? Why or why not?

**Air Cargo Problem 3 -**

|  |  |  |  |
| --- | --- | --- | --- |
| Search | Expansions | Goal Tests | Time Elapsed |
| Breadth First Search | 14663 | 18098 | 95.4451 |
| Depth First Graph Search | 408 | 409 | 1.6652 |
| Uniform Cost Search | 18223 | 18225 | 362.1456 |
| Greedy Best First Graph Search with H\_1 | 5578 | 5580 | 97.6707 |
| A\* Search with H\_1 | 18223 | 18225 | 362.1456 |
| A\* Search with H\_Ignore\_Preconditions | 5118 | 5120 | 82.2090 |
| A\* Search with H\_PG\_Levelsum | 414 | 416 | 1804.0072 |

* Optimal plan:

Load(C1, P1, SFO)

Load(C2, P2, JFK)

Fly(P1, SFO, ATL)

Load(C3, P1, ATL)

Fly(P2, JFK, ORD)

Load(C4, P2, ORD)

Fly(P1, ATL, JFK)

Unload(C1, P1, JFK)

Unload(C3, P1, JFK)

Fly(P2, ORD, SFO)

Unload(C2, P2, SFO)

Unload(C4, P2, SFO)

* Compare and contrast non-heuristic search result metrics:
* Compare and contrast heuristic search result metrics using A\* with the "ignore preconditions" and "level-sum" heuristics:
* What was the best heuristic used in these problems? Was it better than non-heuristic search planning methods for all problems? Why or why not?