**Analisis Masalah**

Diberikan masalah sebagai berikut :

Suatu perusahaan Jasa Transportasi Barang beroperasi untuk mengantarkan muatan besar antar empat kota K1, K2, K3, dan K4. Karena besarnya muatan yang ditransportasikan, setiap kendaraan hanya bisa mengangkut satu barang dalam sekali pengantaran. Perusahaan tersebut kemudian ingin membangun system perencanaan jalur untuk mengoptimasi pengantaran setiap kendaraan.

Lalu kita diminta untuk melakukan penelusuran dengan menggunakan Goal Stack Planning untuk menghasilkan kondisi akhir sebagai berikut :

|  |  |  |
| --- | --- | --- |
| Barang | Saat ini Berada di | Tujuan Kota |
| B1 | K1 | K2 |
| B2 | K2 | K3 |
| B3 | K3 | K1 |
| B4 | K2 | K4 |

Dimana posisi awal kendaraan adalah :

|  |  |
| --- | --- |
| Kendaraan | Saat ini Berada di |
| M1 | K2 |
| M2 | K1 |

**Strategi Penyelesaian Masalah**

Tahapan dalam menyelesaikan masalah dengan Goal Stack Planning adalah :

1. Menentukan state yang dibutuhkan.
2. Menentukan operasi dan PAD -nya.
3. Menentukan initial state dan goal state.
4. Melakukan penelusuran untuk mendapatkan goal state menggunakan Goal Stack Planning.
5. Menuliskan hasil akhir dari state yang diperoleh dan kesimpulan solusi yang diperoleh untuk mendapatkan goal state.

Daftar state yang dibutuhkan :

|  |  |
| --- | --- |
| **States** | **Deskripsi** |
| City(X) | Menjelaskan jika sedang berada di kota X |
| Transport(X) | Menjelaskan tentang kendaraan X yang dipakai |
| EMPTYTRANSPORT | Kendaraan tidak sedang mengangkut barang/muatan kosong |
| Item(X) | Menjelaskan barang X sedang diangkut |
| InCity(X,Y) | X berada di kota Y |
| InTransport(X,Y) | X berada di kendaraan Y |
| TransportOn(X,Y) | Kendaraan X sedang berada di Y |

Operasi dan detail precondition, add, dan delete yang dibutuhkan :

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Operators** | | | | | |
| **PickUp(X,Y,Z)** | | **PutDown(X,Y,Z)** | | **MoveTo(X,Y,Z)** | |
| **P** | Item(X)  Transport(Y)  City(Z)  InCity(X,Z)  TransportOn(Y,Z)  EMPTYTRANSPORT | **P** | Item(X)  Transport(Y)  City(Z)  InTransport(X,Y)  TransportOn(Y,Z) | **P** | Transport(X)  City(Y)  City(Z)  TransportOn(X,Y) |
| **A** | InTransport(X,Y) | **A** | InCity(X,Z)  EMPTYTRANSPORT | **A** | TransportOn(X,Z) |
| **D** | InCity(X,Z)  EMPTYTRANSPORT | **D** | InTransport(X,Y) | **D** | TransportOn(X,Y) |

Berikut ini adalah state awal dan hasil akhir yang diinginkan :

|  |  |  |
| --- | --- | --- |
| **Initial State** |  | **Goal State** |
| Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K1)  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  TransportOn(M2,K1)  EMPTYTRANSPORT | InCity(B1,K2)  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) |

Melakukan penelusuran untuk mendapatkan goal state dari pengantaran barang.

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 1 | InCity(B1,K2)  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K1)  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  TransportOn(M2,K1)  EMPTYTRANSPORT |
| Solution Queue |
|  |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 2 | ~~Item(B1)~~  ~~Transport(M2)~~  ~~City(K1)~~  ~~InCity(B1,K1)~~  ~~TransportOn(M2,K1)~~  ~~EMPTYTRANSPORT~~  **PickUp(B1,M2,K1) 🡪 masuk ke solution queue**  ~~Item(B1)~~  ~~Transport(M2)~~  ~~City(K2)~~  InTransport(B1,M2)  TransportOn(M2,K2)  **PutDown(B1,M2,K2)**  InCity(B1,K2)  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K1)  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  TransportOn(M2,K1)  EMPTYTRANSPORT |
| Solution Queue |
|  |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 3 | ~~Transport(M2)~~  ~~City(K1)~~  ~~City(K2)~~  ~~TransportOn(M2,K1)~~  **MoveTo(M2,K1,K2) 🡪 masuk ke solution queue**  ~~InTransport(B1,M2)~~  TransportOn(M2,K2)  **PutDown(B1,M2,K2)**  InCity(B1,K2)  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  ~~InCity(B1,K1)~~  🡪 DELETE  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  TransportOn(M2,K1)  ~~EMPTYTRANSPORT~~ 🡪 DELETE  InTransport(B1,M2) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 4 | ~~TransportOn(M2,K2)~~  **PutDown(B1,M2,K2) 🡪 masuk ke solution queue**  InCity(B1,K2)  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  ~~TransportOn(M2,K1)~~ 🡪 DELETE  InTransport(B1,M2)  TransportOn(M2,K2) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 5 | ~~Item(B2)~~  ~~Transport(M1)~~  ~~City(K2)~~  ~~InCity(B2,K2)~~  ~~TransportOn(M1,K2)~~  ~~EMPTYTRANSPORT~~  **PickUp(B2,M1,K2) 🡪 masuk ke solution queue**  ~~Item(B2)~~  ~~Transport(M1)~~  ~~City(K3)~~  InTransport(B2,M1)  TransportOn(M1,K3)  **PutDown(B2,M1,K3)**  ~~InCity(B1,K2)~~  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B2,K2)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  ~~InTransport(B1,M2)~~ 🡪 DELETE  TransportOn(M2,K2)  InCity(B1,K2) 🡪 ADD  EMPTYTRANSPORT 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 6 | ~~Transport(M1)~~  ~~City(K2)~~  ~~City(K3)~~  ~~TransportOn(M1,K2)~~  **MoveTo(M1,K2,K3) 🡪 masuk ke solution queue**  ~~InTransport(B2,M1)~~  TransportOn(M1,K3)  **PutDown(B2,M1,K3)**  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  ~~InCity(B2,K2)~~ 🡪 DELETE  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M1,K2)  TransportOn(M2,K2)  InCity(B1,K2)  ~~EMPTYTRANSPORT~~ 🡪 DELETE  InTransport(B2,M1) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 7 | ~~TransportOn(M1,K3)~~  **PutDown(B2,M1,K3) 🡪 masuk ke solution queue**  InCity(B2,K3)  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B3,K3)  InCity(B4,K2)  ~~TransportOn(M1,K2)~~ 🡪 DELETE  TransportOn(M2,K2)  InCity(B1,K2)  InTransport(B2,M1)  TransportOn(M1,K3) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 8 | ~~Item(B3)~~  ~~Transport(M1)~~  ~~City(K3)~~  ~~InCity(B3,K3)~~  ~~TransportOn(M1,K3)~~  ~~EMPTYTRANSPORT~~  **PickUp(B3,M1,K3) 🡪 masuk ke solution queue**  ~~Item(B3)~~  ~~Transport(M1)~~  ~~City(K1)~~  InTransport(B3,M1)  TransportOn(M1,K1)  **PutDown(B3,M1,K1)**  ~~InCity(B2,K3)~~  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B3,K3)  InCity(B4,K2)  TransportOn(M2,K2)  InCity(B1,K2)  ~~InTransport(B2,M1)~~ 🡪 DELETE  TransportOn(M1,K3)  InCity(B2,K3) 🡪 ADD  EMPTYTRANSPORT 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 9 | ~~Transport(M1)~~  ~~City(K3)~~  ~~City(K1)~~  ~~TransportOn(M1,K3)~~  **MoveTo(M1,K3,K1) 🡪 masuk ke solution queue**  ~~InTransport(B3,M1)~~  TransportOn(M1,K1)  **PutDown(B3,M1,K1)**  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  ~~InCity(B3,K3)~~ 🡪 DELETE  InCity(B4,K2)  TransportOn(M2,K2)  InCity(B1,K2)  TransportOn(M1,K3)  InCity(B2,K3)  ~~EMPTYTRANSPORT~~ 🡪 DELETE  InTransport(B3,M1) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 10 | ~~TransportOn(M1,K1)~~  **PutDown(B3,M1,K1) 🡪 masuk ke solution queue**  InCity(B3,K1)  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B4,K2)  TransportOn(M2,K2)  InCity(B1,K2)  ~~TransportOn(M1,K3)~~ 🡪 DELETE  InCity(B2,K3)  InTransport(B3,M1)  TransportOn(M1,K1) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 11 | ~~Item(B4)~~  ~~Transport(M2)~~  ~~City(K2)~~  ~~InCity(B4,K2)~~  ~~TransportOn(M2,K2)~~  ~~EMPTYTRANSPORT~~  **PickUp(B4,M2,K2) 🡪 masuk ke solution queue**  ~~Item(B4)~~  ~~Transport(M2)~~  ~~City(K4)~~  InTransport(B4,M2)  TransportOn(M2,K4)  **PutDown(B4,M2,K4)**  ~~InCity(B3,K1)~~  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B4,K2)  TransportOn(M2,K2)  InCity(B1,K2)  InCity(B2,K3)  ~~InTransport(B3,M1)~~ 🡪 DELETE  TransportOn(M1,K1)  InCity(B3,K1) 🡪 ADD  EMPTYTRANSPORT 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)**  **PutDown(B3,M1,K1)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 12 | ~~Transport(M2)~~  ~~City(K2)~~  ~~City(K4)~~  ~~TransportOn(M2,K2)~~  **MoveTo(M2,K2,K4) 🡪 masuk ke solution queue**  ~~InTransport(B4,M2)~~  TransportOn(M2,K4)  **PutDown(B4,M2,K4)**  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  ~~InCity(B4,K2)~~ 🡪 DELETE  TransportOn(M2,K2)  InCity(B1,K2)  InCity(B2,K3)  TransportOn(M1,K1)  InCity(B3,K1)  ~~EMPTYTRANSPORT~~ 🡪 DELETE  InTransport(B4,M2) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)**  **PutDown(B3,M1,K1)**  **PickUp(B4,M2,K2)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 13 | ~~TransportOn(M2,K4)~~  **PutDown(B4,M2,K4) 🡪 masuk ke solution queue**  InCity(B4,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  ~~TransportOn(M2,K2)~~ 🡪 DELETE  InCity(B1,K2)  InCity(B2,K3)  TransportOn(M1,K1)  InCity(B3,K1)  InTransport(B4,M2)  TransportOn(M2,K4) 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)**  **PutDown(B3,M1,K1)**  **PickUp(B4,M2,K2)**  **MoveTo(M2,K2,K4)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 14 | ~~InCity(B4,K4)~~ | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K2)  InCity(B2,K3)  TransportOn(M1,K1)  InCity(B3,K1)  ~~InTransport(B4,M2)~~ 🡪 DELETE  TransportOn(M2,K4)  InCity(B4,K4) 🡪 ADD  EMPTYTRANSPORT 🡪 ADD |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)**  **PutDown(B3,M1,K1)**  **PickUp(B4,M2,K2)**  **MoveTo(M2,K2,K4)**  **PutDown(B4,M2,K4)** |
|  | bottom |  |

|  |  |  |
| --- | --- | --- |
| No | Stack | Current State |
| 15 |  | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K2)  InCity(B2,K3)  TransportOn(M1,K1)  InCity(B3,K1)  TransportOn(M2,K4)  InCity(B4,K4)  EMPTYTRANSPORT |
| Solution Queue |
| **PickUp(B1,M2,K1)**  **MoveTo(M2,K1,K2)**  **PutDown(B1,M2,K2)**  **PickUp(B2,M1,K2)**  **MoveTo(M1,K2,K3)**  **PutDown(B2,M1,K3)**  **PickUp(B3,M1,K3)**  **MoveTo(M1,K3,K1)**  **PutDown(B3,M1,K1)**  **PickUp(B4,M2,K2)**  **MoveTo(M2,K2,K4)**  **PutDown(B4,M2,K4)** |
|  | bottom |  |

Dari hasil penelusuran yang dilakukan maka didapatkan solusi perpindahan barang sebagai berikut:

|  |  |  |
| --- | --- | --- |
| **Solution** |  | **Goal State** |
| PickUp(B1,M2,K1)  MoveTo(M2,K1,K2)  PutDown(B1,M2,K2)  PickUp(B2,M1,K2)  MoveTo(M1,K2,K3)  PutDown(B2,M1,K3)  PickUp(B3,M1,K3)  MoveTo(M1,K3,K1)  PutDown(B3,M1,K1)  PickUp(B4,M2,K2)  MoveTo(M2,K2,K4)  PutDown(B4,M2,K4) | Transport(M1), Transport(M2)  Item(B1), Item(B2), Item(B3), Item(B4)  City(K1), City(K2), City(K3), City(K4)  InCity(B1,K2)  InCity(B2,K3)  TransportOn(M1,K1)  InCity(B3,K1)  TransportOn(M2,K4)  InCity(B4,K4)  EMPTYTRANSPORT |