1. Solution number and depth

-description: We wanted to evaluate how schedules improve as more solutions are explored at different depths. We found that there was no benefit in going above depth 10 or evaluating more than 100 solutions. After that point there were slight differences in schedules, but the expected utilities were virtually identical. Below are the parameters needed to test at depths 2, 3, 5, 10 and 20.

-initial state:

-parameters:

initial\_state\_filename = "./input\_files/countries.xlsx"

output\_schedule\_filename = "./output\_files/random\_d2.txt"

depth = 2

solution\_limit = 1000

-output:

Number of solutions: 1

Best solution EU: 567364

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

Number of solutions: 5

Best solution EU: 694040

Best Path:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | population | metalElements | timber | landArea | water | metalAlloys | electronics | housing | food | metalAlloysWaste | housingWaste | electronicsWaste | foodWaste |
| Atlantis | 20000 | 1200 | 7000 | 20000 | 40000 | 1500 | 500 | 20000 | 12000 | 1600 | 1800 | 1200 | 2000 |
| Brobdingnag | 14000 | 1200 | 4000 | 20000 | 45000 | 700 | 500 | 18000 | 16000 | 1800 | 1200 | 1000 | 1600 |
| Carpania | 12000 | 2000 | 7000 | 20000 | 45000 | 500 | 1500 | 22000 | 14000 | 1400 | 1600 | 1800 | 2000 |
| Dinotopia | 14000 | 2000 | 20000 | 25000 | 35000 | 700 | 1100 | 16000 | 18000 | 1800 | 1000 | 1600 | 1200 |
| Erewhon | 14000 | 2000 | 20000 | 25000 | 50000 | 1100 | 500 | 20000 | 14000 | 2000 | 1200 | 1800 | 1000 |
| MyCountry | 10000 | 1600 | 19000 | 20000 | 40000 | 700 | 1300 | 18000 | 18000 | 1200 | 1400 | 1000 | 1000 |

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

Number of solutions: 10

Best solution EU: 694040

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

Number of solutions: 50

Best solution EU: 694040

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

Number of solutions: 100

Best solution EU: 694040

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

Number of solutions: 500

Best solution EU: 694040

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

Number of solutions: 1000

Best solution EU: 694040

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

-parameters:

initial\_state\_filename = "./input\_files/countries.xlsx"

output\_schedule\_filename = "./output\_files/random\_d3.txt"

depth = 3

solution\_limit = 1000

-output:

Number of solutions: 1

Best solution EU: 567364

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

Number of solutions: 5

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

Number of solutions: 10

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 51.16279069767442), 'EU: 784670')

Number of solutions: 50

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('electronics', 51.16279069767442), 'EU: 784670')

Number of solutions: 100

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1100.0), 'EU: 784670')

Number of solutions: 500

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('electronics', 51.16279069767442), 'EU: 784670')

Number of solutions: 1000

Best solution EU: 784670

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1100.0), 'EU: 784670')

-parameters:

initial\_state\_filename = "./input\_files/countries.xlsx"

output\_schedule\_filename = "./output\_files/random\_d5.txt"

depth = 5

solution\_limit = 1000

-output:

Number of solutions: 1

Best solution EU: 567364

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

Number of solutions: 5

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

Number of solutions: 10

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

Number of solutions: 50

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 883576')

Number of solutions: 100

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1050.0), 'EU: 883576')

Number of solutions: 500

Best solution EU: 888572

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 843316')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 888572')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 888572')

Number of solutions: 1000

Best solution EU: 888572

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalAlloys', 100), 'EU: 827217')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1100.0), 'EU: 827217')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 888572')

-parameters:

initial\_state\_filename = "./input\_files/countries.xlsx"

output\_schedule\_filename = "./output\_files/random\_d10.txt"

depth = 10

solution\_limit = 1000

-output:

Number of solutions: 1

Best solution EU: 567364

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

Number of solutions: 5

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

Number of solutions: 10

Best solution EU: 916571

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 916571')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 916571')

Number of solutions: 50

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 918949')

Number of solutions: 100

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 51.16279069767442), 'EU: 918949')

Number of solutions: 500

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 918949')

Number of solutions: 1000

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 51.16279069767442), 'EU: 918949')

-parameters:

initial\_state\_filename = "./input\_files/countries.xlsx"

output\_schedule\_filename = "./output\_files/random\_d20.txt"

depth = 20

solution\_limit = 1000

-output:

Number of solutions: 1

Best solution EU: 567364

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

Number of solutions: 5

Best solution EU: 883576

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

Number of solutions: 10

Best solution EU: 916571

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 916571')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 916571')

Number of solutions: 50

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 918949')

Number of solutions: 100

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 51.16279069767442), 'EU: 918949')

Number of solutions: 500

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 918949')

Number of solutions: 1000

Best solution EU: 918949

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 567364')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 694040')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 784670')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 784670')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 843977')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 843977')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 883576')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 883576')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 906815')

('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 906815')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 916089')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 918949')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 51.16279069767442), 'EU: 918949')

2. Equal Countries

-description: We wanted to see what would happen if every country had the exact same resources. Would they even interact if none had an advantage in anything? We gave each country an equal decent amount of each resource and allowed 4 levels of depth. The number of solutions is limited because, as shown in the previous example, utility plateaus. We found that the MyCountry actually performed transforms to produce metalElements, then traded those to another country for electronics. This was interesting because we weren’t sure if the countries would interact. We believe if the other countries had the same transformations available, trades would not occur.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | population | metalElements | timber | landArea | water | metalAlloys | electronics | housing | food | metalAlloysWaste | housingWaste | electronicsWaste | foodWaste |
| Atlantis | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |
| Brobdingnag | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |
| Carpania | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |
| Dinotopia | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |
| Erewhon | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |
| MyCountry | 15000 | 1200 | 6000 | 25000 | 50000 | 1200 | 1000 | 15000 | 18000 | 2000 | 1600 | 1400 | 1500 |

-initial state:

-parameters:

initial\_state\_filename = "./input\_files/equalCountries.xlsx"

output\_schedule\_filename = "./output\_files/equal.txt"

depth = 4

solution\_limit = 100000

-output:

Number of solutions: 1

Best solution EU: 538562

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

Number of solutions: 5

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1206122')

Number of solutions: 10

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Atlantis', ('food', 1166.6666666666667), 'EU: 1206122')

Number of solutions: 50

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('electronics', 48.83720930232558), 'EU: 1206122')

Number of solutions: 100

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 1166.6666666666667), 'EU: 1206122')

Number of solutions: 500

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Erewhon', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Erewhon', ('food', 1166.6666666666667), 'EU: 1206122')

Number of solutions: 1000

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187050')

('TRANSFER', 'Dinotopia', 'MyCountry', ('metalElements', 100), 'EU: 1206122')

('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 1166.6666666666667), 'EU: 1206122')

Number of solutions: 100000

Best solution EU: 1206122

Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 538562')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 969411')

('TRANSFER', 'Dinotopia', 'MyCountry', ('metalElements', 100), 'EU: 1025555')

('TRANSFER', 'MyCountry', 'Dinotopia', ('electronics', 48.83720930232558), 'EU: 1025555')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1206122')