**Different thresholds**

-description: we want to know how different aspects of our definition of models for state quality calculation will influence the solutions we find in our simulation. A very important aspect of our models is how we define thresholds for different types of resources. When we are assigning resource amounts of each resource for different countries, we use the Random function in excel that generates an integer in the range of [0, 10]. We multiply this number with a value n, which can be different for different resources, and add to a minimum value, which can also be different for different resources. So the resource amount that can be generated for a resource to a country is in the range of [min, min+10n]. Our definition of thresholds are also using this way of definition. Originally, the 1st threshold for materials is min + n, the 2nd threshold for materials is min + 4n, and the threshold for waste is min + 5n. We think it is worth experimenting how the results may change if we change these thresholds. For example, we can change the 1st threshold to min + 2n and see how it influences the results.

-initial state:

| Country | population | metalElements | timber | landArea | water | metalAlloys | electronics | housing | food | metalAlloysWaste | housingWaste | electronicsWaste | foodWaste |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atlantis | 11000 | 1900 | 19000 | 100000 | 50000 | 700 | 1400 | 130000 | 210000 | 1100 | 1200 | 1300 | 1500 |
| Brobdingnag | 11000 | 1900 | 19000 | 150000 | 37500 | 1100 | 500 | 120000 | 200000 | 1900 | 2000 | 1100 | 1500 |
| Carpania | 13000 | 2000 | 70000 | 300000 | 52500 | 700 | 700 | 200000 | 190000 | 1600 | 1500 | 1800 | 1300 |
| Dinotopia | 11000 | 1200 | 17000 | 350000 | 37500 | 900 | 1200 | 210000 | 170000 | 1100 | 1600 | 1700 | 1500 |
| Erewhon | 11000 | 2000 | 15000 | 200000 | 50000 | 1400 | 1300 | 200000 | 180000 | 1600 | 1500 | 2000 | 1600 |
| MyCountry | 13000 | 1800 | 13000 | 300000 | 40000 | 800 | 900 | 160000 | 190000 | 1700 | 1800 | 1800 | 1300 |

Test 1

-description:

In this test, the input resources file contains the original thresholds for materials and wastes. Specifically, it is min + n for materials' 1st threshold, min + 4n for materials' 2nd threshold, and min + 5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold original.xlsx"
output_schedule_filename = "./output_files/change_threshold original.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 10
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 50
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 100
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 500
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 1000
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 100000
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')

Test 2
-description:
In this test, the input resources file contains the changed 1st thresholds for materials, the same 2nd threshold for materials and same threshold for wastes, compared with the original thresholds. Specifically, it is min + 2n for materials' 1st threshold, min + 4n for materials' 2nd threshold, and min + 5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold 1st.xlsx"
output_schedule_filename = "./output_files/change_threshold 1st.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 10
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 50
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 100
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 500
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 1000
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')

Number of solutions: 100000
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')

Test 3
-description:
In this test, the input resources file contains the changed 2nd thresholds for materials, the same 1st threshold for materials and same threshold for wastes, compared with the original thresholds. Specifically, it is min + n for materials' 1st threshold, min + 8n for materials' 2nd threshold, and min + 5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold 2nd.xlsx"
output_schedule_filename = "./output_files/change_threshold 2nd.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 10
Best solution EU: 1316548
Best Path:

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 50
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 500
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 1000
Best solution EU: 1316548
Best Path:

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100000
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1062670')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1062670')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1316548')

Test 4
-description:
In this test, the input resources file contains the changed 1st and 2nd thresholds for materials and the same threshold for wastes, compared with the original thresholds. Specifically, it is min + 2n for materials' 1st threshold, min + 8n for materials' 2nd threshold, and min + 5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold 1st+2nd.xlsx"
output_schedule_filename = "./output_files/change_threshold 1st+2nd.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 1316548
Best Path:

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 10
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 50
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 500
Best solution EU: 1316548
Best Path:

('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 1000
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100000
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 1062670')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 2388.8888888888887), 'EU: 1062670')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1316548')

Test 5
-description:
In this test, the input resources file contains the same 1st and 2nd thresholds for materials and the changed threshold for wastes, compared with the original thresholds. Specifically, it is min + n for materials' 1st threshold, min + 4n for materials' 2nd threshold, and min + 7.5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold waste.xlsx"
output_schedule_filename = "./output_files/change_threshold waste.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 10
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 50
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 100
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 500
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 1000
Best solution EU: 709286

Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')
Number of solutions: 100000
Best solution EU: 709286
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 709286')

Test 6
-description:
In this test, the input resources file contains the changed 1st and 2nd thresholds for materials and the changed threshold for wastes, compared with the original thresholds. Specifically, it is min + 2n for materials' 1st threshold, min + 8n for materials' 2nd threshold, and min + 7.5n for wastes' threshold.

-parameters:
initial_state_filename = "./input_files/countries_threshold.xlsx"
initial_resources_filename = "./input_files/Resources_Different_Threshold 1st+2nd +waste.xlsx"
output_schedule_filename = "./output_files/change_threshold 1st+2nd +waste.txt"
depth = 4
solution_limit = 100000

-output:
Number of solutions: 1
Best solution EU: 494686
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
Number of solutions: 5
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')

Number of solutions: 10
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 50
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 500
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Erewhon', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Erewhon', ('food', 2388.8888888888887), 'EU: 1316548')

Number of solutions: 1000
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1201388')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('electronics', 100), 'EU: 1316548')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('food', 2388.8888888888887), 'EU: 1316548')
Number of solutions: 100000
Best solution EU: 1316548
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494686')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890252')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 1062670')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 2388.8888888888887), 'EU: 1062670')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 1316548')

Test Cases Result Explanation:
Comparing the generated results of the 6 tests, we can see that the expected utilities of the best solutions in Test 1 (original thresholds: 1st for materials being min + n, 2nd for materials being min + 4n, the threshold for waste being min + 5n), Test 2 (only change 1st threshold for materials, 1st for materials being min + 2n, 2nd for materials being min + 4n, the threshold for waste being min + 5n), Test 5 (only change threshold for wastes: 1st for materials being min + n, 2nd for materials being min + 4n, the threshold for waste being min + 7.5n) are all same (around 700000). We can also see that the expected utilities of the best solutions in Test 3 (only change 2nd thresholds: 1st for materials being min + n, 2nd for materials being min + 8n, the threshold for waste being min + 5n), Test 4 (change 1st and 2nd thresholds for materials, 1st for materials being min + 2n, 2nd for materials being min + 8n, the threshold for waste being min + 5n), Test 5 (only all thresholds: 1st for materials being min + 2n, 2nd for materials being min + 8n, the threshold for waste being min + 7.5n) are all same (around 1300000). This tells us that only our changes in 2nd threshold influence the decision that MyCountry does in its searches for successor states. When we look closely at the generated schedules, we can find that for Test 1, 2, and 5, the best schedule for MyCountry is doing 2 transforms of 128 electronics. But for Test 3, 4, and 6, the best schedule for MyCountry is doing 2 transforms of 128 electronics, then doing one trade that transfers some food for the other country's electronics, and doing another transform of 128 electronics. The reason behind this difference can be because of the initial resource amount of each resources for MyCountry. If we check the initial state of MyCountry, we can see that all of its resources have amount equal to or larger than min + 3n, which is even larger than our changed 1st threshold. Since the first threshold is the survival threshold,

this indicates that MyCountry is in a relatively resource-rich state, so it will not eagerly search for operators that can increase its most demanded resources for survival. This is also the reason for why we do not see solutions change when we change the 1st threshold for materials. According to our models, the materials are usually most encouraged to be traded to other countries when their amount is between 1st and 2nd thresholds because the market is saturated after the 2nd threshold. Because most of the resources for MyCountry are between min + 4n and min + 8n, the resources for MyCountry are mostly above original 2nd threshold (min + 4n). This makes MyCountry more inclined to do transform instead of transfer. And since electronics' resource amount is low but weight is high, it can give the most increase in state quality among all possible transforms for MyCountry. So MyCountry would like to do 2 transforms of electronics for Test 1, 2, and 5 when the 2nd threshold for materials is only min + 4n. But when we change it to min + 8n in Test 3, 4, and 6, a lot of the resources for MyCountry are then between 1st and 2nd thresholds. This makes MyCountry more inclined to do trades, and since electronics' amount is still relatively smaller but can bring large increase in state quality for MyCountry, MyCountry are inclined to trade its other resources for another country's electronics. The reason behind no change in wastes can be because the weights and amounts for wastes are low, so they do not play very important roles in any types of operations in our defined world. So even if we make big changes to the thresholds, no change is made in solutions.

**Weight scaling:**

In this test we considered how the changes in our grouped resources (raw materials, produced materials, waste materials), will affect the trading or transformation between and within countries. We scaled each resource group weight separately increasing from 0.5, 0.75, 1.25. What we expected was that the weight scaling for raw materials scaled up will reflect a hoarding of sorts for raw materials, for the scaling in produced materials we expected that the countries will value transforms which generate the produced materials more with the 0.5, 0.75and 1.25 up scale. Last, we also scaled the weights of all waste expecting a similar preference for transforms compared to trades.

raw materials weight 1.5x

-initial state:

-parameters:

initial_state_filename = "./input_files/countries.xlsx"

output_schedule_filename = "./output_files/equal1.txt"

Number of solutions: 1
Best solution EU: 617764
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
Number of solutions: 5
Best solution EU: 1379511
Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 10
Best solution EU: 1379511
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 50
Best solution EU: 1379511
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 100
Best solution EU: 1379511
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 500
Best solution EU: 1379511
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 1000
Best solution EU: 1379511

Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')
Number of solutions: 100000
Best solution EU: 1379511
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 617764')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1111975')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1379511')

raw materials 1.75x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal2.txt"

Number of solutions: 1
Best solution EU: 657365
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
Number of solutions: 5
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 10
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 50
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 100
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 500
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 1000
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')
Number of solutions: 100000
Best solution EU: 1475742
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 657365')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys',

192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1183257')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1475742')

raw materials 2.25x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal3.txt"

Number of solutions: 1
Best solution EU: 736567
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
Number of solutions: 5
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 10
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 50
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 100
Best solution EU: 1668203

Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 500
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 1000
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')
Number of solutions: 100000
Best solution EU: 1668203
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 736567')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1325821')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1668203')

produced materials 1.5x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal4.txt"

Number of solutions: 1
Best solution EU: 728641

Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
Number of solutions: 5
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 10
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 50
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 100
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 500
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 1000
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')
Number of solutions: 100000
Best solution EU: 1588115
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 728641')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1311554')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1588115')

produced materials 1.75x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal5.txt"

Number of solutions: 1
Best solution EU: 823680
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
Number of solutions: 5
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')
Number of solutions: 10

Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')
Number of solutions: 50
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')
Number of solutions: 100
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')
Number of solutions: 500
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')
Number of solutions: 1000
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')

Number of solutions: 100000
Best solution EU: 1788647
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 823680')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1482625')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1788647')

produced materials 2.25x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal6.txt"

Number of solutions: 1
Best solution EU: 1013759
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
Number of solutions: 5
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 10
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 50
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 100
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 500
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 1000
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')
Number of solutions: 100000
Best solution EU: 2189712
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1013759')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1824767')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 2189712')

waste materials 1.5x

-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal7.txt"

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: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 10
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 50
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100
Best solution EU: 1187051
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: 969412')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 500
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 1000
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100000
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')

waste materials 1.75x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal8.txt"

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: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 10
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 50
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 500
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 1000
Best solution EU: 1187051

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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100000
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')

waste materials 2.25x
-initial state:
  -parameters:
    initial_state_filename = "./input_files/countries.xlsx"
    output_schedule_filename = "./output_files/equal9.txt"

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: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 10
Best solution EU: 1187051
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: 969412')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 50
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 500
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 1000
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')
Number of solutions: 100000
Best solution EU: 1187051
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: 969412')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 1187051')

**Results:** Looking across all 9 tests with 3 subtests, we did not expect that an increase in the weight of raw materials will still push transforms as preferred over transfers as shown in the equal1.txt, equal2.txt, and equal3.txt. Also, the expected utility for the raw materials for a scale of 1.5, 1.75, and 2.25 upscale of raw materials weight increases as expected because we prioritize higher values. Now an explanation that we settled on for the increased transforms is that raw materials were hoarded by each country without a want to acquire any in trades between others and themselves. Now, for the rest of the scaling we expected such a focus on transforms because produced resources and waste amounts were increased through transforms. Overall, we saw an increase in expected utility as the best schedule displayed.

**Inequality in the World**

- Description: For this test we wanted to look at how inequality in the world and the actor's relative wealth affect the schedules being generated by our simulation. As a measurement of a world state's wealth inequality, we used the mean log deviation(MLD) of each country's state quality. This is normalized so that an MLD of 0 represents completely equal state qualities and 1 represents only a single country having any resources at all. To measure the actor's relative quality(ARQ) we used the proportion of the actor's state quality to the average state quality. An ARQ of 1 represents the actor having average wealth while ARQ > 1 means the actor is wealthy and ARQ < 1 means the actor is poor. We ran 9 simulations in which the world was equal, slightly unequal or extremely unequal and the actor was poor, average or rich.

- Test 1
    - Description: The MLD is ~0 and the ARQ is ~0.5 representing nearly equal world in which the actor is poor.
    - Parameters:
        - initial_state_filename = "./input_files/countries_threshold.xlsx"
        - initial_resources_filename = "./input_files/MLD0_ARQ0.5.xlsx"
        - output_schedule_filename = "./output_files/MLD0_ARQ0.5.txt"
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 340946
MLD: 0.032380
ARQ: 0.521300
Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
Number of solutions: 5
Best solution EU: 601028
MLD: 0.034980
ARQ: 0.506232
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 450223')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 534566')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 598923')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 601028')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 601028')
Number of solutions: 10
Best solution EU: 601028
MLD: 0.034980
ARQ: 0.506232
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 450223')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 534566')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 598923')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 601028')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1050.0), 'EU: 601028')
Number of solutions: 50
Best solution EU: 601028
MLD: 0.034980
ARQ: 0.506232
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 450223')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 534566')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 598923')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 601028')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1050.0), 'EU: 601028')
Number of solutions: 100
Best solution EU: 601028
MLD: 0.034980
ARQ: 0.506232
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 450223')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 534566')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 598923')
('TRANSFER', 'Carpania', 'MyCountry', ('metalElements', 100), 'EU: 601028')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 1050.0), 'EU: 601028')
Number of solutions: 100
Best solution EU: 601028
MLD: 0.034980
ARQ: 0.506232
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 340946')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 450223')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 534566')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 549995')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('timber', 1050.0), 'EU: 549995')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 601028')

- Test 2
    - Description: The MLD is 0 and the ARQ is 1 representing completely equal world.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”
        - initial_resources_filename = “./input_files/MLD0_ARQ1.xlsx”
        - output_schedule_filename = “./output_files/MLD0_ARQ1.txt”
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 538562
MLD: 0.000013
ARQ: 0.988428
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: 1209508
MLD: 0.000182
ARQ: 0.958599
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 10
Best solution EU: 1209508
MLD: 0.000182
ARQ: 0.958599
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 50
Best solution EU: 1209508
MLD: 0.000182
ARQ: 0.958599
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('food', 1166.6666666666667), 'EU: 1209508')
Number of solutions: 100
Best solution EU: 1209508
MLD: 0.000178
ARQ: 0.958599
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')
('TRANSFER', 'Brobdingnag', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Brobdingnag', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 100
Best solution EU: 1209508
MLD: 0.000178
ARQ: 0.958599
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')
('TRANSFER', 'Dinotopia', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Dinotopia', ('food', 1166.6666666666667), 'EU: 1209508')

- Test 3
    - Description: The MLD is ~0 and the ARQ is ~2 representing nearly equal world in which the actor is wealthy.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”

        - initial_resources_filename = “./input_files/MLD0_ARQ2.xlsx”
        - output_schedule_filename = “./output_files/MLD0_ARQ2.txt”
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 504965
MLD: 0.068229
ARQ: 1.982283
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
Number of solutions: 5
Best solution EU: 717283
MLD: 0.066172
ARQ: 1.965504
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 597752')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 667164')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 717283')
Number of solutions: 10
Best solution EU: 717283
MLD: 0.066172
ARQ: 1.965504
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 597752')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 667164')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 717283')
Number of solutions: 50
Best solution EU: 717283
MLD: 0.066172
ARQ: 1.965504
Best Path:

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 597752')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 667164')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 717283')
Number of solutions: 100
Best solution EU: 717283
MLD: 0.066172
ARQ: 1.965504
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 597752')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 667164')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 717283')
Number of solutions: 100
Best solution EU: 717283
MLD: 0.066172
ARQ: 1.965504
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 504965')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 597752')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 667164')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 717283')

- Test 4
    - Description: The MLD is ~0.25 and the ARQ is ~0.5 representing a sizeable but not extremely unequal world in which the actor is average.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”
        - initial_resources_filename = “./input_files/MLD0.25_ARQ0.5.xlsx”
        - output_schedule_filename = “./output_files/MLD0.25_ARQ0.5.txt”
        - depth = 5

        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 473761
MLD: 0.280556
ARQ: 0.470321
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')
Number of solutions: 5
Best solution EU: 852770
MLD: 0.283243
ARQ: 0.457449
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 852770')
Number of solutions: 10
Best solution EU: 852770
MLD: 0.283243
ARQ: 0.457449
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 852770')
Number of solutions: 50
Best solution EU: 852770
MLD: 0.283243
ARQ: 0.457449
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 852770')
Number of solutions: 100
Best solution EU: 852770
MLD: 0.283243
ARQ: 0.457449
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 852770')
Number of solutions: 100
Best solution EU: 852770
MLD: 0.283243
ARQ: 0.457449
Best Path:
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 473761')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 852770')

- Test 5
    - Description: The MLD is ~0.25 and the ARQ is ~1 representing a sizeable but not extremely unequal world in which the actor is average.
    - Parameters:
        - initial_state_filename = "./input_files/countries_threshold.xlsx"
        - initial_resources_filename = "./input_files/MLD0.25_ARQ1.xlsx"
        - output_schedule_filename = "./output_files/MLD0.25_ARQ1.txt"
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 494767
MLD: 0.254733
ARQ: 1.048162
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
Number of solutions: 5
Best solution EU: 951983
MLD: 0.254890
ARQ: 1.062958
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890358')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 951983')
Number of solutions: 10
Best solution EU: 951983
MLD: 0.254890
ARQ: 1.062958

Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890358')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 951983')
Number of solutions: 50
Best solution EU: 951983
MLD: 0.254890
ARQ: 1.062958
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890358')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 951983')
Number of solutions: 100
Best solution EU: 951983
MLD: 0.254890
ARQ: 1.062958
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890358')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 951983')
Number of solutions: 100
Best solution EU: 951983
MLD: 0.254890
ARQ: 1.062958
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494767')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890358')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 951983')

- Test 6
    - The MLD is ~0.25 and the ARQ is ~2 representing a sizeable but not extremely unequal world in which the actor is average.

- Parameters:
  - initial_state_filename = “./input_files/countries_threshold.xlsx”
  - initial_resources_filename = “./input_files/MLD0.25_ARQ2.xlsx”
  - output_schedule_filename = “./output_files/MLD0.25_ARQ2.txt”
  - depth = 5
  - solution_limit = 100
- Output:

Number of solutions: 1
Best solution EU: 193432
MLD: 0.249820
ARQ: 2.013956
Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
Number of solutions: 5
Best solution EU: 495180
MLD: 0.245029
ARQ: 1.994176
Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 348179')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 348179')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 470044')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 470044')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 495180')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 495180')
Number of solutions: 10
Best solution EU: 495180
MLD: 0.246124
ARQ: 1.995386
Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 348179')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 348179')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 470044')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 470044')
('TRANSFER', 'Carpania', 'MyCountry', ('metalAlloys', 100), 'EU: 495180')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 1100.0), 'EU: 495180')
Number of solutions: 50
Best solution EU: 495180
MLD: 0.246375
ARQ: 1.994054

Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 348179')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 348179')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 470044')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 470044')
('TRANSFER', 'Erewhon', 'MyCountry', ('metalAlloys', 100), 'EU: 495180')
('TRANSFER', 'MyCountry', 'Erewhon', ('timber', 1100.0), 'EU: 495180')
Number of solutions: 100
Best solution EU: 495180
MLD: 0.246280
ARQ: 1.994420
Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 348179')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 348179')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 470044')
('TRANSFER', 'MyCountry', 'Dinotopia', ('timber', 2150.0), 'EU: 470044')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalAlloys', 100), 'EU: 495180')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 1100.0), 'EU: 495180')
Number of solutions: 100
Best solution EU: 495180
MLD: 0.247882
ARQ: 1.996965
Best Path:
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 193432')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 193432')
('TRANSFER', 'Carpania', 'MyCountry', ('electronics', 100), 'EU: 348179')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 2150.0), 'EU: 348179')
('TRANSFER', 'Dinotopia', 'MyCountry', ('electronics', 100), 'EU: 470044')
('TRANSFER', 'MyCountry', 'Dinotopia', ('timber', 2150.0), 'EU: 470044')
('TRANSFER', 'Carpania', 'MyCountry', ('metalAlloys', 100), 'EU: 495180')
('TRANSFER', 'MyCountry', 'Carpania', ('timber', 1100.0), 'EU: 495180')

- Test 7
    - Description: The MLD is ~0.5 and the ARQ is ~0.5 representing an extremely unequal world in which the actor is poor.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”
        - initial_resources_filename = “./input_files/MLD0.5_ARQ0.5.xlsx”
        - output_schedule_filename = “./output_files/MLD0.5_ARQ0.5.txt”
        - depth = 5

        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 494729
MLD: 0.488814
ARQ: 0.492414
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
Number of solutions: 5
Best solution EU: 952264
MLD: 0.485746
ARQ: 0.509341
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890363')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 952264')
Number of solutions: 10
Best solution EU: 952264
MLD: 0.485746
ARQ: 0.509341
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890363')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 952264')
Number of solutions: 50
Best solution EU: 952264
MLD: 0.485746
ARQ: 0.509341
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890363')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 952264')
Number of solutions: 100
Best solution EU: 952264

MLD: 0.485746
ARQ: 0.509341
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890363')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 952264')
Number of solutions: 100
Best solution EU: 952264
MLD: 0.485746
ARQ: 0.509341
Best Path:
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 494729')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 890363')
('TRANSFORM', 'MyCountry', (('population', 192), ('metalElements', 128), ('metalAlloys', 128)), (('population', 192), ('electronics', 128), ('electronicsWaste', 128)), 'EU: 952264')

- Test 8
    - Description: The MLD is ~0.5 and the ARQ is ~1 representing an extremely unequal world in which the actor is average.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”
        - initial_resources_filename = “./input_files/MLD0.5_ARQ1.xlsx”
        - output_schedule_filename = “./output_files/MLD0.5_ARQ1.txt”
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 538562
MLD: 0.495631
ARQ: 0.993148
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: 1209508
MLD: 0.495293
ARQ: 0.963196
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 10
Best solution EU: 1209508
MLD: 0.495293
ARQ: 0.963196
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 50
Best solution EU: 1209508
MLD: 0.495293
ARQ: 0.963196
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')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('food', 1166.6666666666667), 'EU: 1209508')
Number of solutions: 100
Best solution EU: 1209508
MLD: 0.495520
ARQ: 0.963985

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')
('TRANSFER', 'Dinotopia', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Dinotopia', ('electronics', 48.83720930232558), 'EU: 1209508')
Number of solutions: 100
Best solution EU: 1209508
MLD: 0.495520
ARQ: 0.963985
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', ('electronics', 48.83720930232558), 'EU: 1206122')
('TRANSFER', 'Atlantis', 'MyCountry', ('metalElements', 100), 'EU: 1209508')
('TRANSFER', 'MyCountry', 'Atlantis', ('electronics', 48.83720930232558), 'EU: 1209508')

- Test 9
    - The MLD is ~0.5 and the ARQ is ~2 representing an extremely unequal world in which the actor is wealthy.
    - Parameters:
        - initial_state_filename = “./input_files/countries_threshold.xlsx”
        - initial_resources_filename = “./input_files/MLD0.5_ARQ2.xlsx”
        - output_schedule_filename = “./output_files/MLD0.5_ARQ2.txt”
        - depth = 5
        - solution_limit = 100
    - Output:

Number of solutions: 1
Best solution EU: 193418
MLD: 0.480669
ARQ: 2.015587
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')

Number of solutions: 5
Best solution EU: 565900
MLD: 0.462950
ARQ: 1.991896
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 348154')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 348154')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 441763')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 513177')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 565900')
Number of solutions: 10
Best solution EU: 565900
MLD: 0.462950
ARQ: 1.991896
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 348154')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 348154')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 441763')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 513177')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 565900')
Number of solutions: 50
Best solution EU: 565900
MLD: 0.462950
ARQ: 1.991896
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 348154')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 348154')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 441763')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 513177')

('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 565900')
Number of solutions: 100
Best solution EU: 565900
MLD: 0.462950
ARQ: 1.991896
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 348154')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 348154')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 441763')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 513177')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 565900')
Number of solutions: 100
Best solution EU: 565900
MLD: 0.462950
ARQ: 1.991896
Best Path:
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 193418')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 193418')
('TRANSFER', 'Atlantis', 'MyCountry', ('electronics', 100), 'EU: 348154')
('TRANSFER', 'MyCountry', 'Atlantis', ('timber', 2150.0), 'EU: 348154')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 441763')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 513177')
('TRANSFORM', 'MyCountry', (('population', 320), ('metalElements', 64), ('timber', 320), ('metalAlloys', 192), ('landArea', 64)), (('population', 320), ('housing', 64), ('housingWaste', 64)), 'EU: 565900')

- Results and analysis

| Test | Initial MLD | Final MLD | Initial ARQ | Final ARQ | Expected Utility |
|---|---|---|---|---|---|
| 1 | 0.030936 | 0.034980 | 0.530062 | 0.506232 | 601028 |
| 2 | 0 | 0.000178 | 1 | 0.958599 | 1209508 |
| 3 | 0.070406 | 0.066172 | 1.999822 | 1.965504 | 707283 |
| 4 | 0.278010 | 0.284217 | 0.483133 | 0.452939 | 852770 |
| 5 | 0.254643 | 0.254890 | 1.037349 | 1.062958 | 952983 |
| 6 | 0.251509 | 0.247882 | 2.021784 | 1.996965 | 495180 |
| 7 | 0.491184 | 0.485746 | 0.480049 | 0.509341 | 952264 |
| 8 | 0.495629 | 0.495520 | 1.004765 | 0.963985 | 1209508 |

| | | | | | |
|---|---|---|---|---|---|
| 9 | 0.498422 | 0.462950 | 2.024543 | 1.991896 | 565900 |

From this we see that the simulation finds schedules with the most expected utility when the actor has average wealth and the least when it is wealthy. The low gains when the actor is wealthy can be explained by the logistic nature of our state quality function. There is a diminished reward when the state quality is high. When the ARQ is low, the utility of the schedules is low because the actor does less transfers due to small resource quantities not meeting the utility threshold.

When the actor is poor, it does better in a less equal world. This way there are other poor countries to trade with. When the actor is wealthy, it does worse in a less equal world because there are less viable trade partners. The inequality in the world and actor's relative quality generally decrease throughout a schedule even when the actor is already the wealthiest country. This means that the trading strategy is mostly non-exploitive as other countries are able to improve as well.