**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.