Defining a variable in Pyomo:

initialize = A function (or Python object) that gives a starting value for the variable; this is particularly important for non-linear models

<https://software.sandia.gov/downloads/pub/pyomo/PyomoOnlineDocs.html#_variables>

Why different initial (searching) value of a variable gives different solutions?

“IPOPT is designed to cover a wide range of optimisation problems, so it uses some fairly general numeric optimisation methods. I'm not familiar with the details of IPOPT but usually this sort of approach relies on picking a starting point, looking at the curvature of the objective function in the neighbourhood of that starting point, and following the curvature "downhill" until they find a local optimum. Different starting points can lead to different results. In this case IPOPT is probably defaulting to zero for the starting point, so it's right on top of that local minimum. As Erwin's suggested, if you specify a different starting point it might find the unboundedness.

Gurobi is designed specifically for quadratic/linear problems, so it uses very different methods which aren't susceptible to local-minimum issues, and it will probably be much more efficient for quadratics. But it doesn't support more general objective functions.”

<https://stackoverflow.com/questions/49787184/ampl-ipopt-gives-wrong-optimal-solution-while-solve-result-is-solved?rq=1>

ESS optimization with different initial values for P\_PV\_Output:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Initialize | NA | 800 | 1000 | 1100 | 1150 | 1200 | 1250 | 1300 |
| 0 | 87.22 | 93.69 | 113.92 | 90.46 | 110.86 | 87.22 | 93.69 | 86.39 |
| 1 | 71.25 | 76.93 | 96.01 | 77.69 | 92.98 | 71.25 | 76.93 | 70.85 |
| 2 | 70.06 | 75.55 | 1300.00 | 75.66 | 90.87 | 70.06 | 75.55 | 69.83 |
| 3 | 73.58 | 78.98 | 96.34 | 79.17 | 93.41 | 73.58 | 78.98 | 73.01 |
| 4 | 75.72 | 80.89 | 96.71 | 81.70 | 93.93 | 75.72 | 80.89 | 75.05 |
| 5 | 74.13 | 78.96 | 1198.72 | 79.81 | 1198.72 | 74.13 | 78.96 | 73.96 |
| 6 | 76.95 | 82.01 | 807.25 | 82.54 | 92.47 | 76.95 | 82.01 | 76.80 |
| 7 | 80.61 | 292.52 | 292.52 | 292.52 | 292.52 | 80.61 | 292.52 | 83.64 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21 | 95.59 | 226.50 | 95.59 | 95.59 | 226.50 | 226.50 | 95.59 | 95.59 |
| 22 | 105.98 | 105.98 | 105.98 | 105.98 | 105.98 | 105.98 | 105.98 | 105.98 |
| 23 | 101.59 | 101.59 | 101.59 | 101.59 | 101.59 | 101.59 | 101.59 | 101.59 |
| ValueOfObjFunction | 10144.05 | 9763.12 | 6752.09 | 9894.02 | 8556.91 | 10013.15 | 9894.02 | 10144.05 |

ESS optimization with different initial values for P\_PV\_Output:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initialize | NA | 800 | 1000 | 1100 |
| 0 | 87.22 | 87.22 | 87.22 | 87.22 |
| 1 | 71.25 | 71.25 | 71.25 | 71.25 |
| 2 | 70.06 | 70.06 | 70.06 | 70.06 |
| 3 | 73.58 | 73.58 | 73.58 | 73.58 |
| 4 | 75.72 | 75.72 | 75.72 | 75.72 |
| 5 | 74.13 | 74.13 | 74.13 | 74.13 |
| 6 | 76.95 | 76.95 | 76.95 | 76.95 |
| 7 | 80.61 | 80.61 | 80.61 | 80.61 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 |
| 12 | 0.00 | 0.00 | 0.00 | 0.00 |
| 13 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 |
| 18 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 | 0.00 | 0.00 | 0.00 | 0.00 |
| 20 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21 | 95.59 | 95.59 | 95.59 | 95.59 |
| 22 | 105.98 | 105.98 | 105.98 | 105.98 |
| 23 | 101.59 | 101.59 | 101.59 | 101.59 |
| ValueOfObjFunction | 10144.05 | 10144.05 | 10144.05 | 10144.05 |
| Execution time | 2.526 | 2.513 | 1.035 | 0.557 |