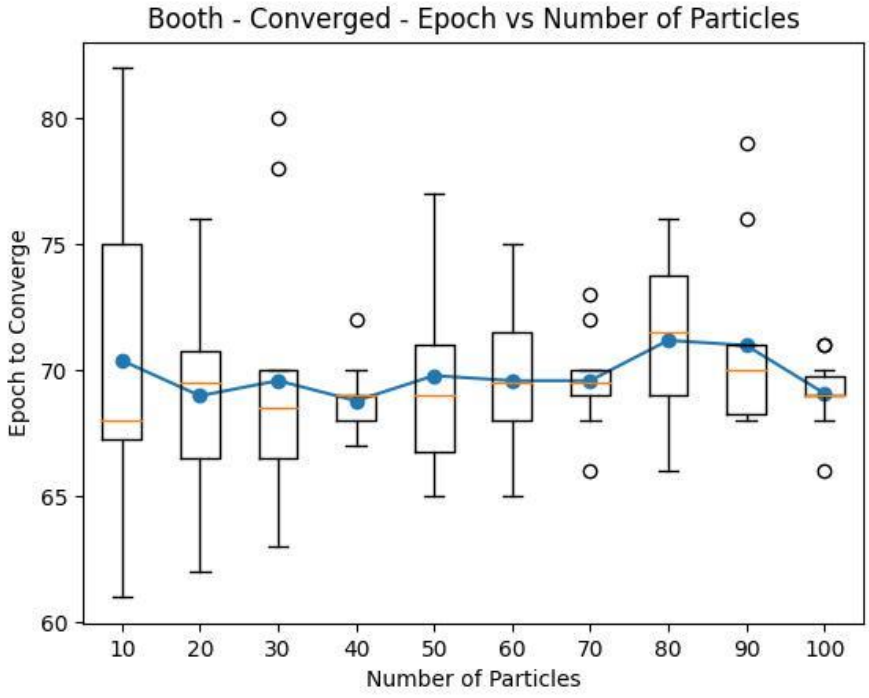
From my testing, parameter selection seems to have a large impact on performance. However, it depends on the parameter and optimization function being used. For instance, in Graph 1, the mean is around 70 for all number of particles and the values range only from 60 to 83. Here, the Booth optimization function is being used. In this example, 40, 70, and 100 particles all have a tight distribution and reach a solution with a low number of epochs. Furthermore, all 10 of the number of particles for each value converged. Continuing with the Booth function inertia, cognition, and social parameters all showed a similar concave increasing graph, whereas an increase in the parameter increased the number of epochs required to reach a solution. The graphs showing this data can be seen as Graph 2, Graph 3, and Graph 4. Each of these parameters also had runs where no solution was found, as seen in Graph 9, Graph 10, and Graph 11.

In comparison, when using the Rosenbrock function, the parameters values make a larger difference. As seen in Graph 5, the number of epochs required to converge is much larger than when using the Booth function. Furthermore, as seen in Graph 12, there are some values that did not converge. This is true for all parameters when using the Rosenbrock function. By looking at Graph 6 and Graph 8, both the inertia and social parameters seem to follow a quadratic form when using the Rosenbrock function. The closer the values are to the middle of the testing values, the faster they converge. The cognition value, however, seems to follow a pattern similar to a linear function until the values reach 3.1, in which it is more likely to not find a solution. This can be seen in Graph 7.

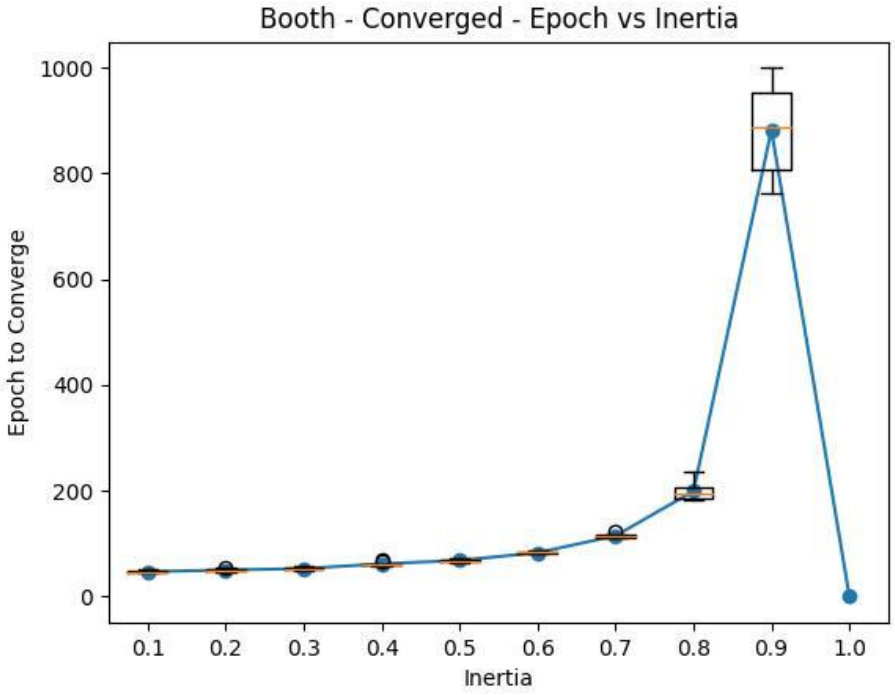
Given this information, it appears there are some optimal values for each parameter. When using the Booth function, the best values for the number of particles seem to be 40, 70, and 100. Although there are other values that reach a solution faster, these values show more consistency in reaching the solution faster. For inertia, the lower the value, the better. However, at 0.1, there are some values that do not converge. So, the best value for inertia when using the Booth function would be 0.2 or 0.3. This information can be seen in Graph 2 and Graph 9. Both cognition and social parameters follow a similar curve. Here again, the lower value, the better. For cognition, 0.1 can be used but 0.2 must be used for social as there are some that don't converge when the social value is 0.1.

When using the Rosenbrock function, the values change quite drastically. For the number of particles, the best values seem to be between 60 and 70, as seen in Graph 5. Inertia, when using the Rosenbrock function, is best set at 0.5 or 0.7; this is because they have the lowest values required to converge and did not have any tests where they did not converge. Even though 0.3 looks like a tighter distribution, 8 tests did not converge, as seen in Graph 13. Cognition from Graph 7 is harder to determine a perfect value. There are several tests that did not converge when cognition was set to 0.1, 0.2, and 0.6, as seen from Graph 14. My best guess would be 0.3 or 0.4, but given my tests, there is no agreement that a solution would be found at these values. A safer value would be cognition set to 0.8. In terms of social values, it seems the best would be when set to 1.7. In my testing, this value produced one outlier with a higher number of epochs required to converge, but 1.7 or 1.8 would be fine given my current information.

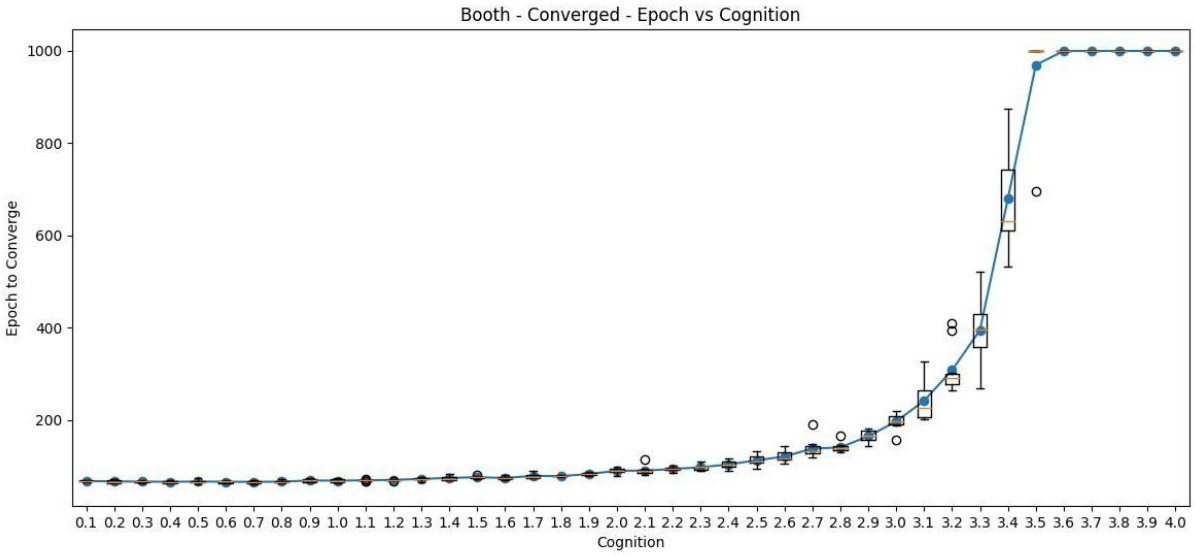
From the information I gathered, each parameter seems to follow a rough pattern, whether that is quadratic or linear or something similar. From this, there are values that perform better or worse depending on the function that the parameter is producing. I believe the functions that are being produced by the parameters are directly influenced by the optimization function. Given this hypothesis, we could assume that every parameter has some line though the optimization function. The values that run closer to the solution would require less epoch to get to that solution. This is just a hypothesis, though.



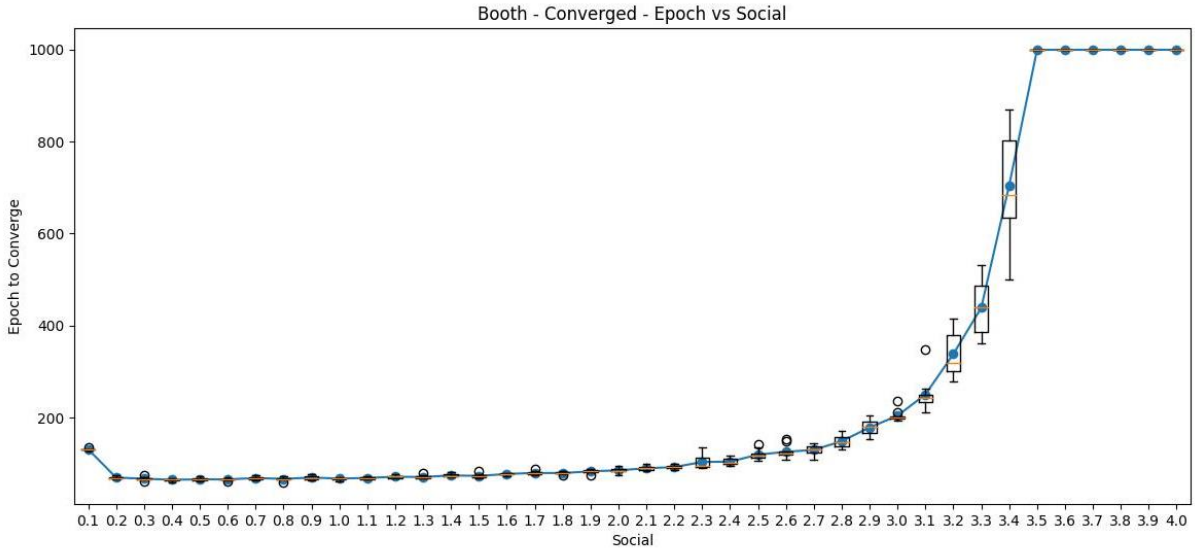
Graph 1



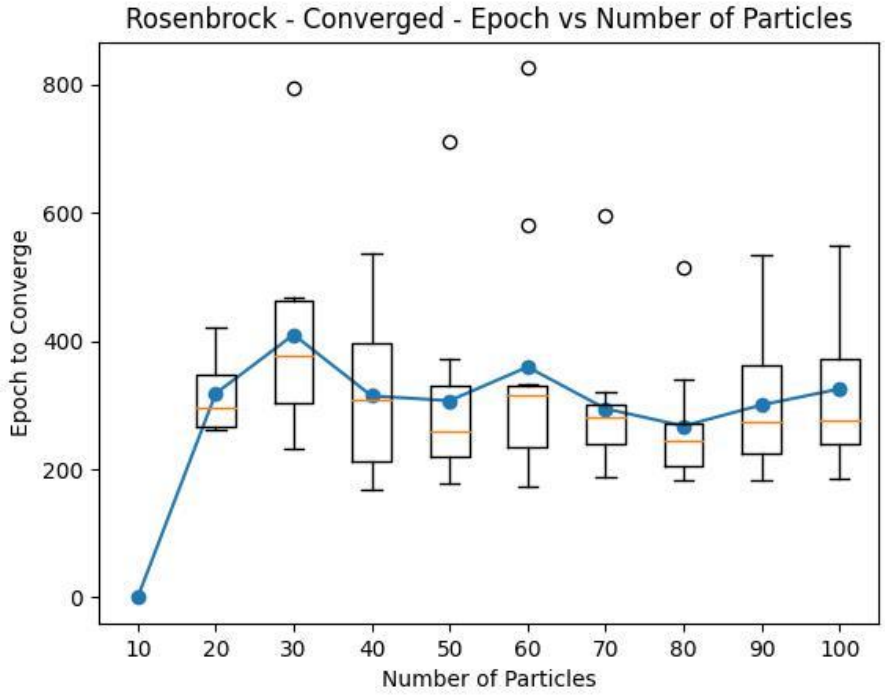
Graph 2



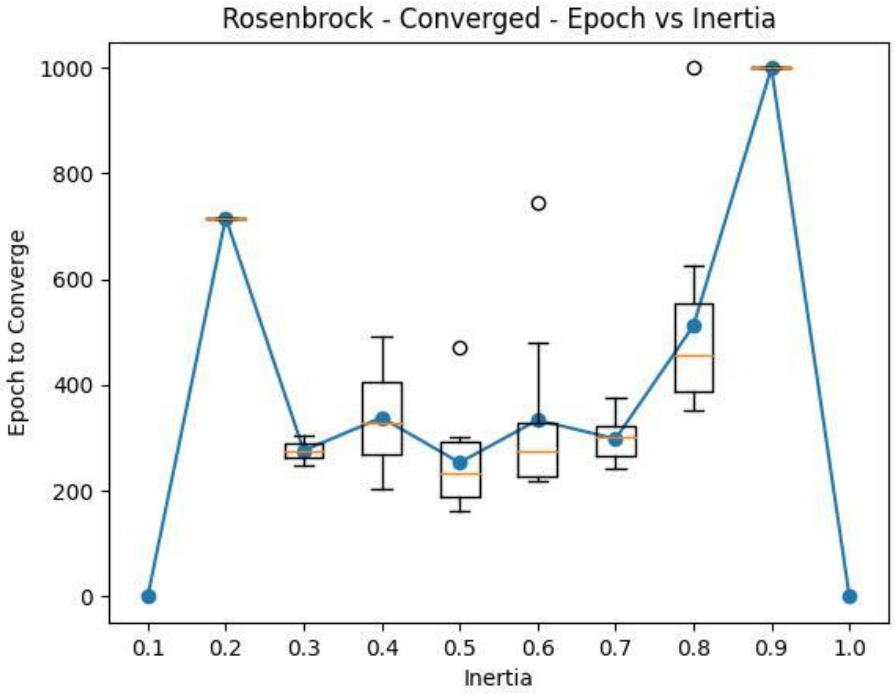
Graph 3



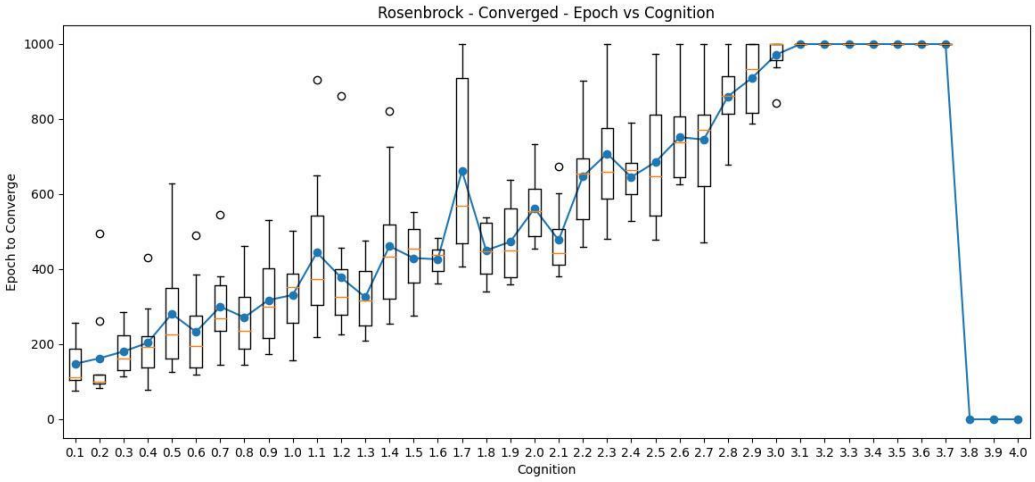
Graph 4



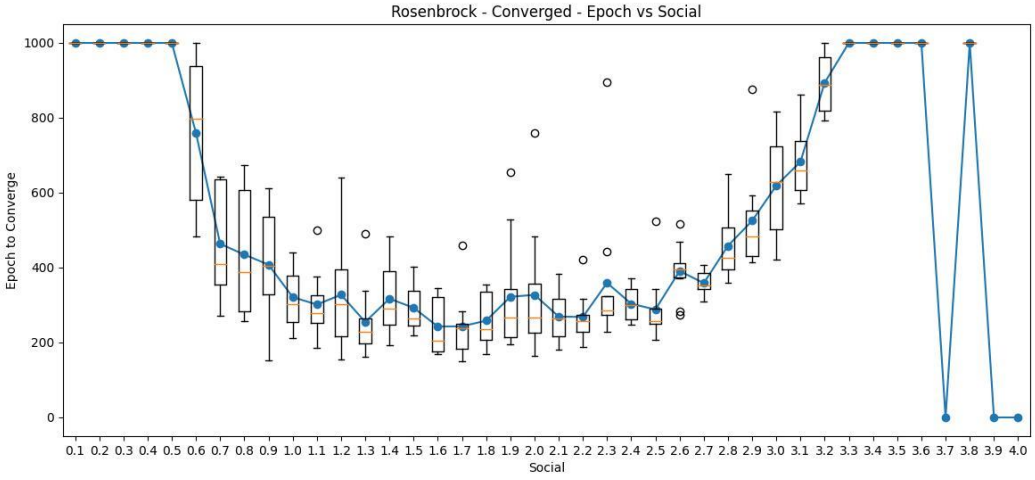
Graph 5



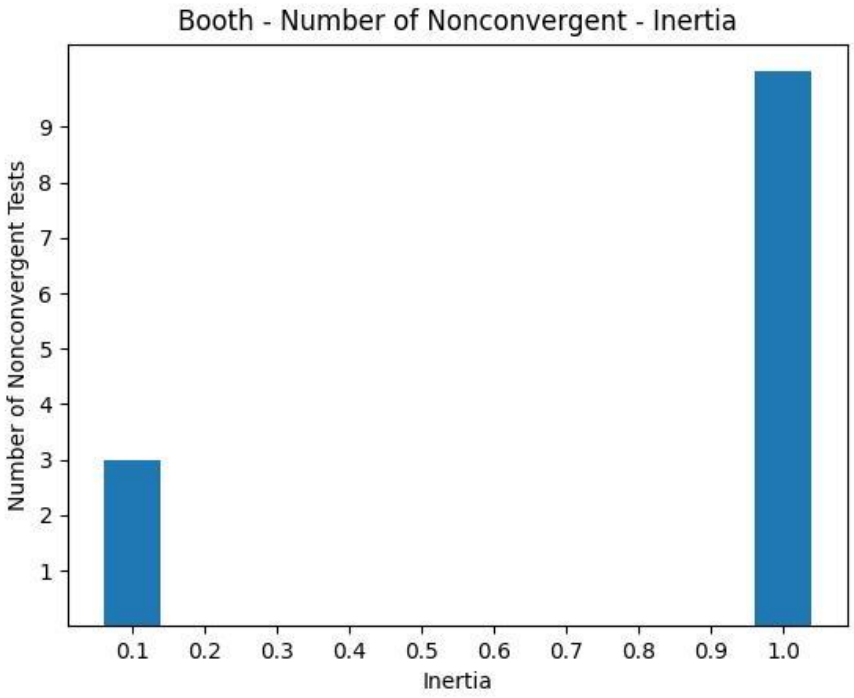
Graph 6



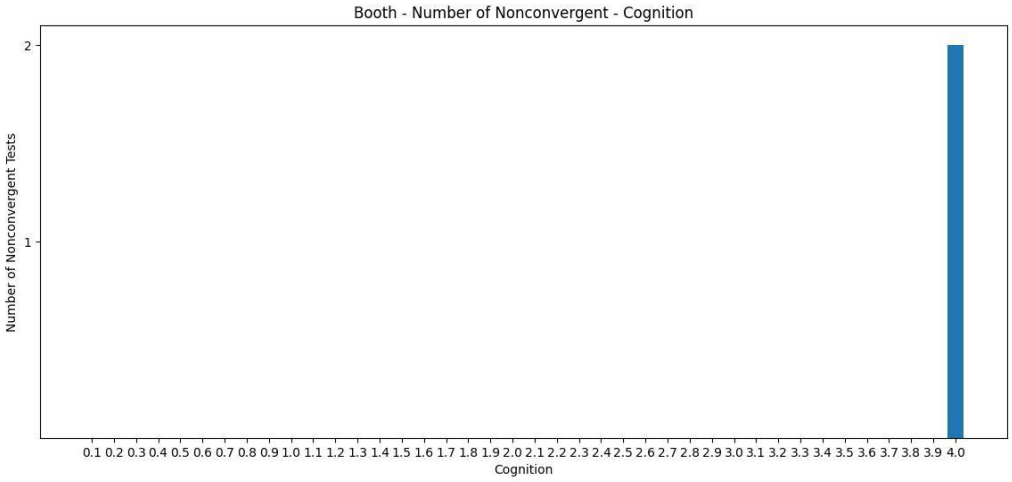
Graph 7



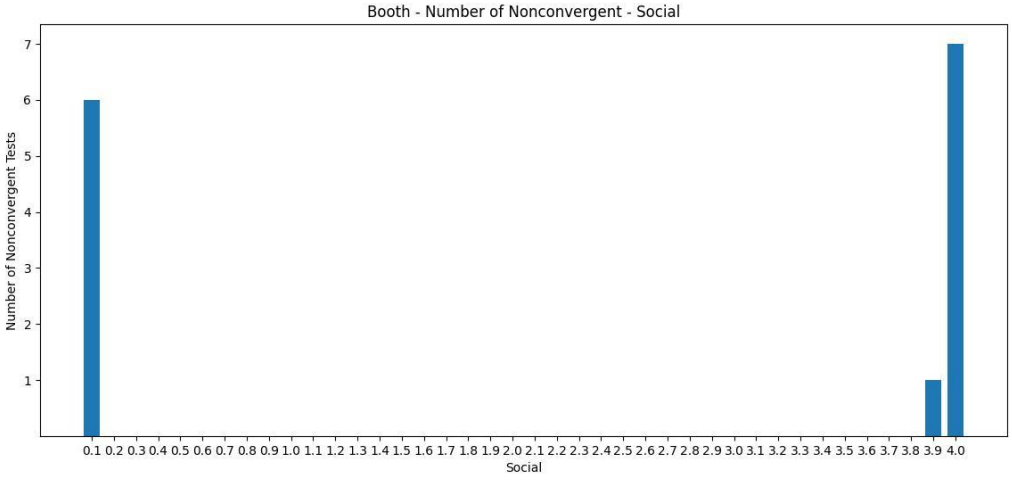
Graph 8


Booth - Number of Nonconvergent - Inertia
Number of Nonconvergent Tests
1
2
3
4
5
6
7
8
9
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Inertia

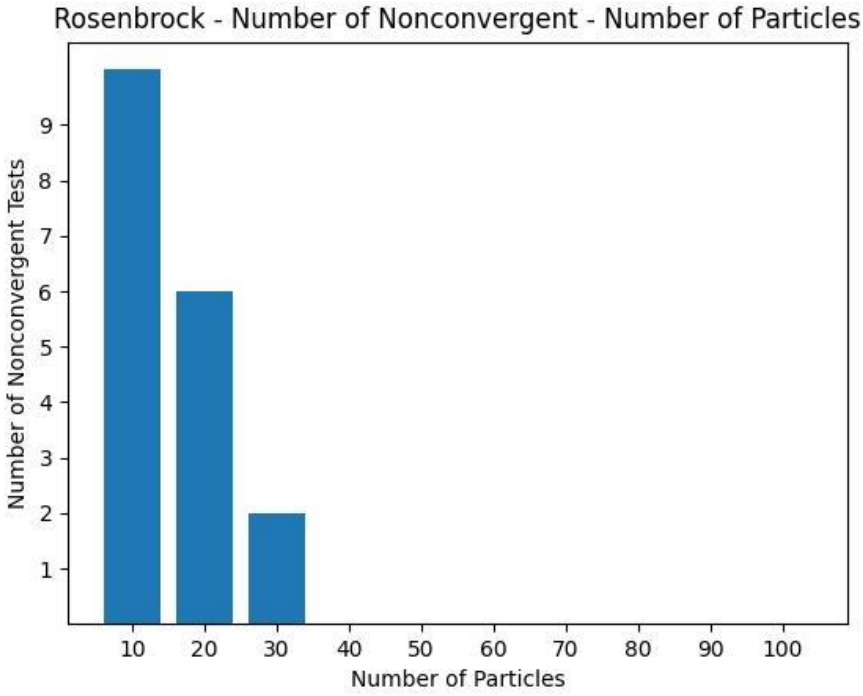
Graph 9



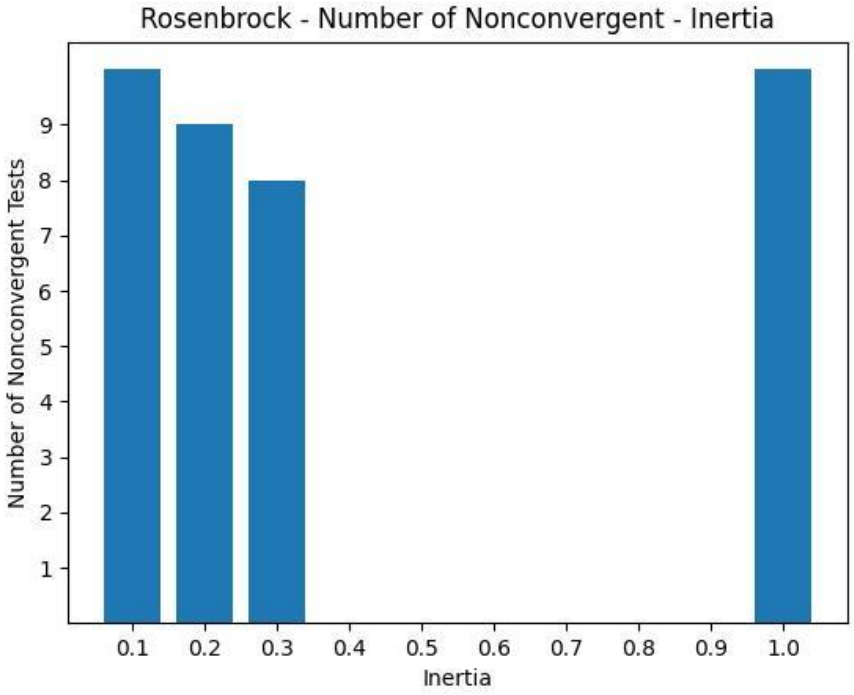
Graph 10



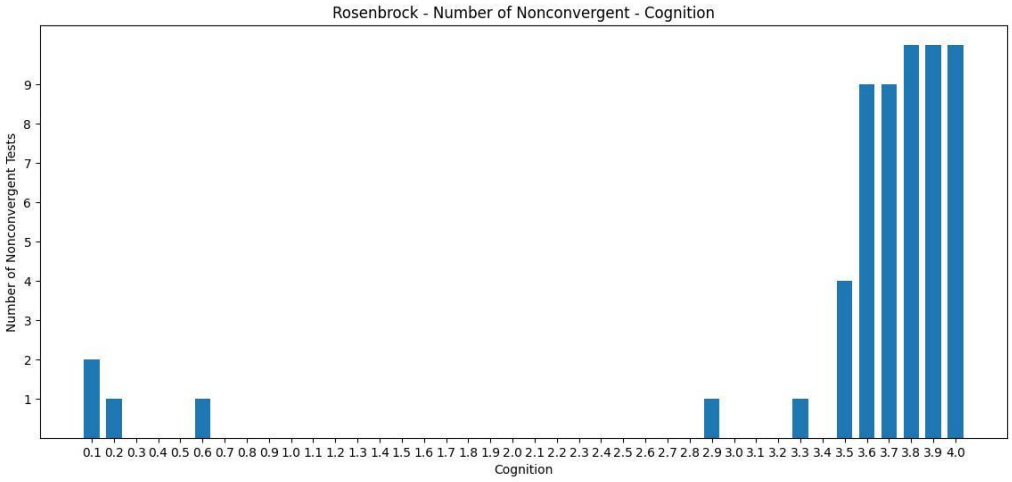
Graph 11



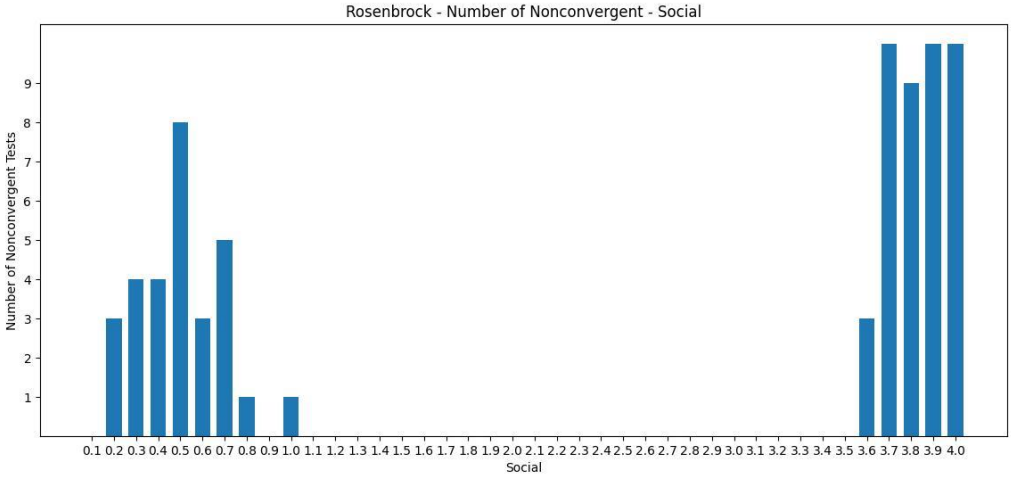
Graph 12



Graph 13



Graph 14



Graph 15