# Question 1

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ECE 457A: assignment 4

Daivik Goel, Lichen Ma, Bosco Han

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| --- | --- | --- | --- | --- | --- | --- |
| **Population** | **Inertia** | **Speed Limit** | **Personal Best** | **Global Best** | **Best Value** | **Ticks Stopped at** |
| 30 | 0.60 | 2 | 1.7 | 1.7 | 1 | 25 |
| 30 | 0.60 | 2 | 1.494 | 1.494 | 1 | 37 |
| 30 | 0.60 | 6 | 1.7 | 1.7 | 1 | 56 |
| 30 | 0.60 | 6 | 1.494 | 1.494 | 0.9091 | 6583 |
| 30 | 0.729 | 2 | 1.7 | 1.7 | 1 | 13 |
| 30 | 0.729 | 2 | 1.494 | 1.494 | 0.911 | 7212 |
| 30 | 0.729 | 6 | 1.7 | 1.7 | 0.8893 | 5763 |
| 30 | 0.729 | 6 | 1.494 | 1.494 | 1 | 54 |
| 80 | 0.60 | 2 | 1.7 | 1.7 | 0.8425 | 6892 |
| 80 | 0.60 | 2 | 1.494 | 1.494 | 0.9826 | 8012 |
| 80 | 0.60 | 6 | 1.7 | 1.7 | 1 | 6 |
| 80 | 0.60 | 6 | 1.494 | 1.494 | 1 | 28 |
| 80 | 0.729 | 2 | 1.7 | 1.7 | 0.9453 | 6113 |
| 80 | 0.729 | 2 | 1.494 | 1.494 | 0.9253 | 5672 |
| 80 | 0.729 | 6 | 1.7 | 1.7 | 1 | 87 |
| 80 | 0.729 | 6 | 1.494 | 1.494 | 1 | 65 |

Looking through the data it seems difficult to try finding a correlation between the parameters and the speed of convergence/best value. Before analyzing the data it should be noted that if the ticks stopped at value is >100 that means it was the value I decided to stop the simulation at assuming that the algorithm would never converge on the true best value. Thus these values cannot be taken into speed consideration

If we break down to results by the parameter, failure to converge and average ticks on successful convergence, we get the following result.

|  |  |  |
| --- | --- | --- |
| Parameter | Failure to converge | Average Ticks on successful convergence |
| Population Size: 30 | 3/8 | 37 |
| Population Size: 80 | 4/8 | 46.5 |
| Inertia Size: 0.6 | 3/8 | 30.4 |
| Inertia Size: 0.729 | 4/8 | 54.75 |
| Speed Limit: 2 | 5/8 | 25 |
| Speed Limit: 6 | 2/8 | 49.33 |
| Personal/Global Best: 1.494 | 4/8 | 43.5 |
| Personal/Global Best: 1.7 | 3/8 | 37.4 |
| Average | 3.5/8 | 40.49 |

Looking through these results we see that on average our failure to converge was 3.5/8 and on successful convergence we had an average speed of 40.49.

First looking at major outliers we see that speed limit had the biggest effect in terms of convergence and average ticks on successful convergence. Where with a speed limit of 6 we had to lowest failure to converge conversely, we had the highest failure to converge with a speed limit of 2. However, we also have the 2nd highest time for successful convergence with a highest speed limit of 6 while we had the lowest time for successful convergence with a limit of 2. Of course, this could come to randomness as the tick difference is just a mere 25 but it is something to note. An explanation of 2 having a higher failure to converge could come down to the fact that the particles seem to be stuck in their local optima and with the speed being set to two they cannot escape and converge to the right value. Hence increasing the speed to 6 gave us a much lower failure to converge.

Otherwise, the rest of the parameters seems to have minimal differences in their failure to converge. There is speed variation between the different parameters but this seems quite minimal and can come down to the random setup at the beginning.

Looking at the motion formulation that Net logo provides, the biggest difference is that NetLogo has a (1 – particle\_inertia) in its velocity calculation (line 116 – 123). They mention that in canonical PSO, the expression is not there however they added it so the slider provided in the application can vary particle motion from a range of moving in a straight line (1.0) to it always moving towards the best spots (0.0). This shouldn’t change much as it will converge to the same results.

# Question 2

# Question 3