**CO656 – Assignment 1 – GA for the TSP: Optimal Configuration Notes**

**groetschel.tsp**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Selection | Crossover | Mutation | Best Result | Average Result | Execution Time (ms) |
| Tournament | Cycle | Exchange | 1331 | 1565 | 14989 |
| Tournament | Cycle | Inversion | 1272 | 1372 | 14990 |
| Tournament | Partially Mapped | Exchange | 1272 | 1509 | 78201 |
| Tournament | Partially Mapped | Inversion | 1272 | 1355 | 69522 |
| Roulette | Cycle | Exchange | 1380 | 1669 | 75010 |
| Roulette | Cycle | Inversion | 1279 | 1494 | 76279 |
| Roulette | Partially Mapped | Exchange | 1330 | 1574 | 127696 |
| Roulette | Partially Mapped | Inversion | 1318 | 1475 | 128498 |

\*100 runs using 150 population size and 5000 generations

Inversion mutation produces better results than exchange mutation. Execution time difference is largely negligible.

The Partially mapped crossover method produced better results than cycle crossover, though taking longer.

Roulette selection is worse than tournament selection in all aspects.

**dantzig.tsp**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Selection | Crossover | Mutation | Best Result | Average Result | Execution Time (ms) |
| Tournament | Cycle | Exchange | 859 | 1030 | 18232 |
| Tournament | Cycle | Inversion | 704 | 765 | 18132 |
| Tournament | Partially Mapped | Exchange | 825 | 1025 | 194940 |
| Tournament | Partially Mapped | Inversion | 699 | 759 | 194636 |

\*100 runs using 150 population size and 5000 generations

Inversion mutation continues to beat exchange mutations results.

Partially mapped crossover continues to beat cycle crossovers results, however not when considering the execution time increase of ~970%.

**dantzig.tsp – Tournament/Cycle/Inversion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Population | Generations | Best Result | Average Result | Execution Time (ms) |
| 50 | 100 | 1229 | 1501 | 297 |
| 50 | 1000 | 744 | 829 | 1501 |
| 50 | 5000 | 706 | 772 | 6431 |
| 150 | 100 | 1016 | 1203 | 666 |
| 150 | 1000 | 710 | 767 | 4064 |
| 150 | 5000 | 704 | 769 | 18432 |
| 300 | 100 | 903 | 1056 | 1416 |
| 300 | 1000 | 706 | 759 | 8017 |
| 300 | 5000 | 699 | 755 | 37906 |

\*100 runs using tournament selection, cycle crossover and inversion mutation methods

Increase of both population and generations offers diminishing returns.

Population size increase holds a near 1:1 correlation on execution time increase. Optimum is likely between 150 and 300.

The number of generations has a higher impact upon the results and near a 2:1 impact upon execution time. Optimum is likely ~5000.