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1.] 8 QUEENS PROBLEM :

1. Changes to optimize Genetic Algorithm :

-Random Selection :

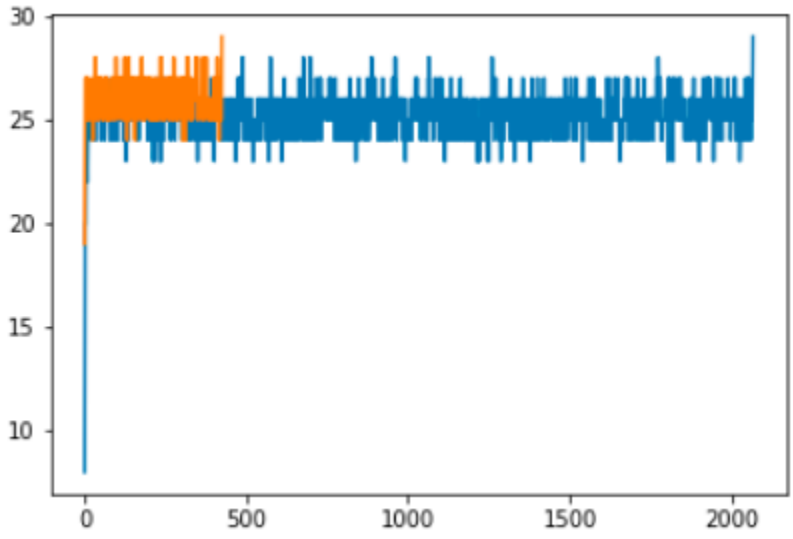
- Selecting two states with the best fitness
- Changing the mutate function ensures the algorithm wont get stuck at local maxima

- Mutate :

- the new mutate functions mutates the current array at two positions instead of one.
- And the probability at which mutate function is called is changed to one.
- Mutate function is important because it ensures that the algorithm does not get stuck at the local maxima.

- Size of population :

- Increased the size of the population from 20 to 60
- Increasing the size of the population optimizes the number of iterations each iteration takes more time to execute
- Theoretically the number of iteration should improve by a factor of 3
- If we decrease the size the time take to find the solution is optimized but number of iterations decreases



This is a graph of iterations v max fitness of the population. The orange line is the optimized genetic algorithm and the blue line is the non optimized algorithm. The orange line converges faster as compared to the blue line.

- Reproduce :
    - Tried to implement a reproduce function which ensures no rows are repeated.
    - This works only if the both the parents have no repeated rows.
    - Since we are starting with an initial state with all the queens in the same row, this method doesn't work

2.] Travelling Salesman Problem :

- Terminating factor :
    - This genetic algorithm terminates when it encounters a state where all adjacent states have finite distance between them

- Random Selection :
    - Selecting two states with best fitness
    - The mutate function of the TSP already makes two changes so as to not go in an invalid state
    - Also changed the probability of mutation to 1

- Size of Population :
    - Increased the size of the population from 20 to 40
    - Similar to the 8 queens problem an increase in the population size
    - If we decrease the size of the population the time taken to converge decreases significantly but the number of iterations increases
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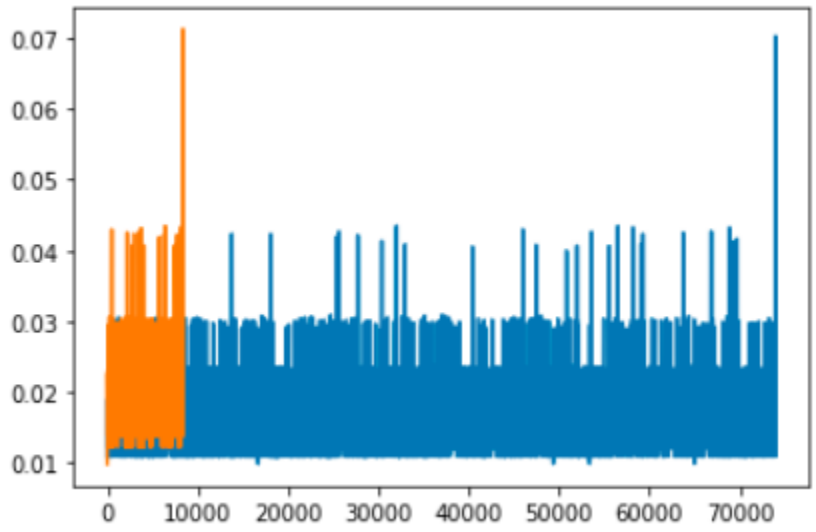

The orange line represents the optimized GA for tsp and the blue represents the non-optimized GA.