# Traveling Sales Person using GA and SA

GROUP MEMBERS:

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# Simulated Annealing

## Problem Formulation

* **States:** A chromosome(an array) having genes in the form of ‘city’ objects
* **Actions and Successor function:** Copy current state and swap two genes (cities) of it
* **Fitness function:** 1/Distance (of the whole state i.e path)
* **Schedule function:** temperature = temp \* (coolingRate\*\*step) (Exponential Multiplicative)

# Genetic Algorithms

## Problem Formulation

* **Chromosome design:** An array having objects of cities as the genes
* **Fitness function:** 1/Distance (of the whole state i.e. path)
* **Crossover methods used:** Take half of a parent, copy that half to child. Now add remaining (non-occurring) from other parent
* **Mutation method used:** Swap two genes (cities)
* **Termination conductions used:** Fixediterations

# Result

In this section you will give results on form of following table. You can also create graph but that is optional.

Table 1Simulated Annealing Effect of temperature on results

(Temperature = 10000)

|  |  |  |
| --- | --- | --- |
| Rate of temp decrease | Time consumed to find goal | Fitness of goal |
| 0.95 | 9.6s | 8.73e-6 |
| 0.97 | 16.8s | 9.52e-6 |
| 0.99 | 46.5s | 1.12e-5 |

Table 2 Genetic Algorithm Effect of population size on results

(Iterations = 1000)

|  |  |  |
| --- | --- | --- |
| k | Time consumed to find goal | Fitness of goal |
| 10 | 20.5s | 5.23e-6 |
| 20 | 40.1s | 5.94e-6 |
| 25 | 51s | 6.04e-6 |

Table 2 Genetic Algorithm Effect of mutation rate on results

(Iterations = 1000 & Population = 10)

|  |  |  |
| --- | --- | --- |
| alpha | Time consumed to find goal | Fitness of goal |
| 10 | 20.7s | 4.28e-6 |
| 40 | 20.4s | 5.04e-6 |
| 70 | 21.0s | 5.19e-6 |

# Discussions and Conclusion

**What worked best?** In genetic, high mutation rate and more population led to more fitness. While in simulated, cooling rate closest to 1 (but not 1) led to more fitness.

**What didn’t work?** In SA,schedule function that doesn’t ensure temperature convergence exponentially **wouldn’t work.** Also, cooling rate = 1 didn’t work, as schedule function was ‘exponential multiplication’ and it wasn’t changing the temperature at rate = 1. On the side of genetic, there was a problem of **‘premature convergence’** in the way I implemented tournament selection. That led to suboptimal solution or stuck. After applying selection intervals, problem was solved.