

# COS 314 Assignment 1

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## Technical specifications:

The project is to allow us to see the effective of the Iterative Local Search and Simulated Annealing algorithm using the campus as the scenario with the total distance between the 5 campuses, the point is to minimize the time traveled when visiting all the 5 campuses. In short testing the best possible route.

The Iterative Local Search is a graph traversal and path-finding method that can determine the shortest route in a weighted graph between start and goal nodes. (It is a kind of iterative deepening depth-first search).

Algorithm configuration:

The key components are generating initial solution, local search, perturbation, acceptance, and criterion.

Initial solution generation: This is to generate random order of the campus.

Local search: This is to search and try all permutation to find the optimal route with within the different campuses.

Terminate after the completing the specific number of iterations.

On the other hand, Simulated annealing is a probabilistic algorithm which tests points across a solution space to find the lowest minima. The algorithm selects the distance between the current point and the trial point through a probability.

Key component: probability theory, genetic algorithm, permutation, local search and search algorithm.

Algorithm configuration:

The acceptance criterion: SA accepts worse solutions with a certain probability, which decreases exponentially with time(temperature). This allows the algorithm to escape local optima and explore the solution space more extensively.

Cooling schedule: SA decreases the temperature over time according to a cooling schedule. The cooling schedule controls the rate at which the algorithm transitions from exploration to exploitation.

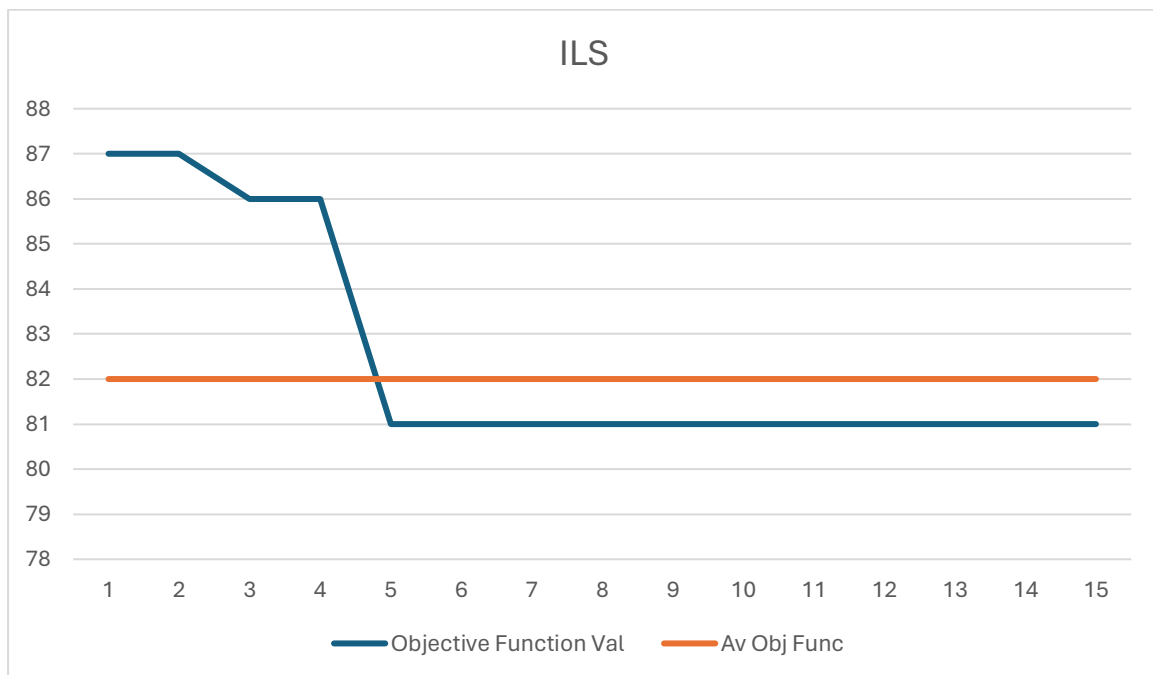
Termination criteria: The algorithm terminated after completing the specified number of iterations.

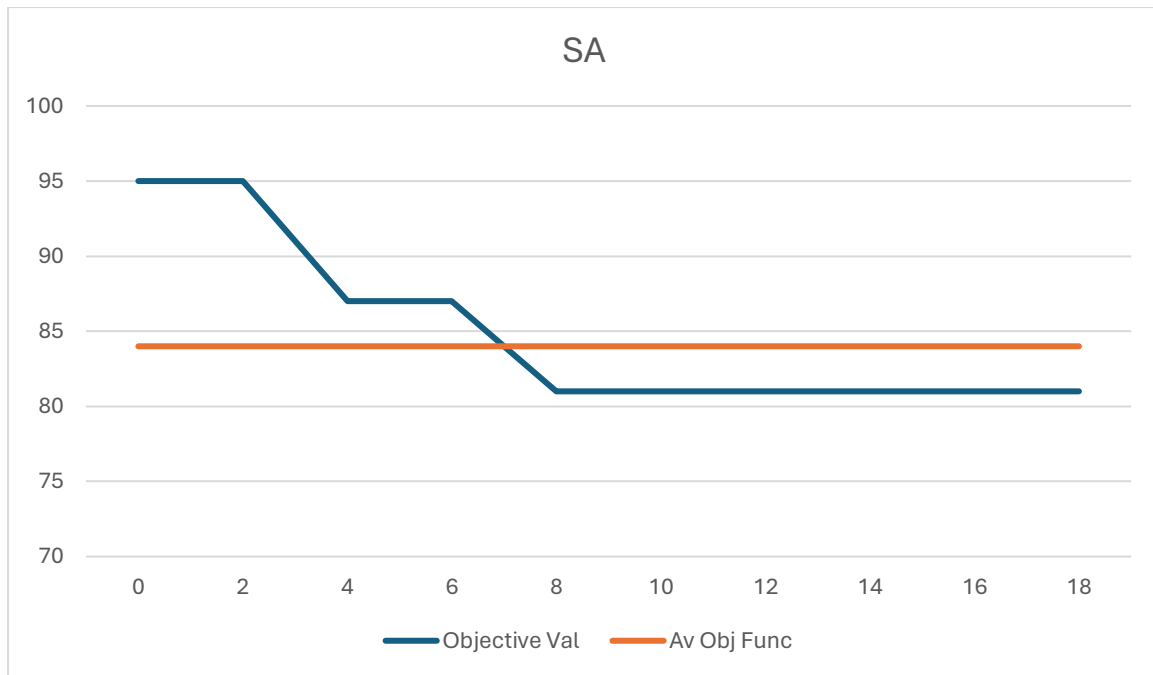
### **Presentation of result:**

Problem set	ILS	SA
Best solution	Hatfield -> Hillcrest -> Groenkloof -> Prinshof -> Mamelodi	Hatfield -> Mamelodi -> Prinshof -> Groenkloof -> Hillcrest
Objective function Val	81	81
Runtime	0	0
Av Obj Func	82	84

### **Graphical plot Representation:**

Campus	Hatfield	Hillcrest	Groenkloof	Prinsof	Mamelodi
Hatfield	0	15	20	22	30
Hillcrest	15	0	10	12	25
Groenkloof	20	10	0	8	22
Prinsof	22	12	8	0	18
Mamelodi	30	25	22	18	0





### **Discussion and conclusion:**

The result of ILS algorithm with other optimization techniques, particularly SA, several factors should be considered to assess their performance effectively.

The Solution, the ILS often focuses on exploiting local optima efficiently through iterative improvement, which can lead to finding high-quality solutions. Compare this with SA, which utilizes probabilistic acceptance of worse solutions to escape local optima, potentially exploring a wider solution space.

Compare the implementation complexity and ease of deployment for each algorithm. ILS may require fine-tuning of parameters such as the number of iterations, neighborhood structures, and perturbation operators. On the other hand, SA typically involves fewer parameters but require careful selection of the cooling schedule and acceptance criteria.

ILS and SA algorithm are both effective solutions for the scenario. Overall, the selection of the most suitable algorithm depends on a careful consideration of the problem context, including its complexity, resource constraints, and optimization objectives. By understanding the unique characteristics and capabilities of each algorithm, practitioners can make informed decisions to tackle optimization problems effectively.