# Solving Travelling Salesman Problem using Simulated Annealing

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April 14, 2015

# Outline

# Travelling Salesman Problem

### Definition

A Travelling Salesman Problem asks the following question: Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city?

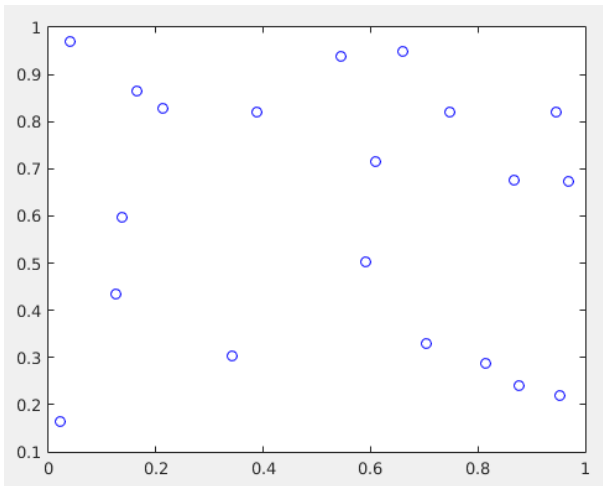# Simple Travelling Salesman Problem with 20 cities



Figure: Showing 20 cities at different position

# Simulated Annealing

### Definition

Simulated annealing (SA) is a generic probabilistic metaheuristic for the global optimization problem of locating a good approximation to the global optimum of a given function in a large search space. It is often used when the search space is discrete (e.g., all tours that visit a given set of cities).

# Modelling of Problem

## Objective

Minimise the total distance travelled by Salesman
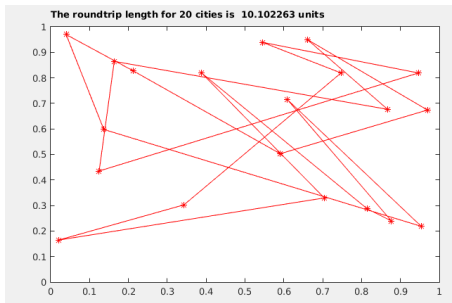
Randomly index the cities as 1,2,3,4 .... n



Figure: Showing 20 cities with travel route

# Distance function and Swaps

Calculate Distance

- Recursively add distance from i to i+1 starting from 1, and go till n-1.
- Then add the distance of n from 1;

## Swap

Swapping is just changing the index of cities

Example temp = 5, 5 = 20 , 20 = temp

# Iteration

- Calculate the distance.
- Based on temperature decide the numbers of Swaps.
- Produce a new city list based on random swaps.
- Calculate the distance again.
- If distance is less than old distance make your new city list as current list.
- If distace is more based on probablity decide which city list to choose.

# Optimised path for Salesman
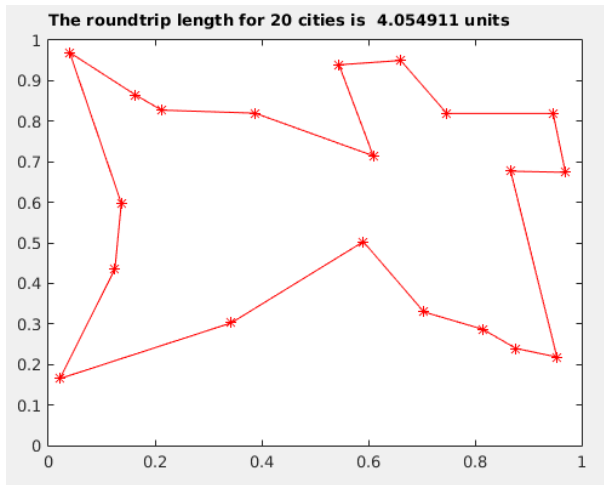


Figure: Showing 20 cities with optimised travel route

# Conclusions

- Most of the time results are exactly same as the real answer.
- Sometime we did't get the exact solution, but the answer is too near to real solution.
- This algorithm takes much less time than brute force method.