Parallel Genetic Algorithm to Optimize Travelling Salesman Problem

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The Idea

- Investigating the efficiency of parallel computation on the Travelling Salesman Problem using Genetic Algorithm.
- Performance estimation and parallelism profiling will be attempted based on OpenMP-based parallel program techniques.

Travelling Salesman Problem

- Optimization problem
- Compute lowest cost of a complete path that crosses all the nodes exactly once and returns to the starting node.
- Generally solved using Dynamic Programming approach.

Genetic Algorithm

- Uses concepts of evolutionary biology like recombination, inheritance, mutation, crossover.
- Replicates Darwin’s Theory of Natural Selection - Survival of the fittest.
- Comprises of fitness evaluation, selection, crossover and mutation phases.

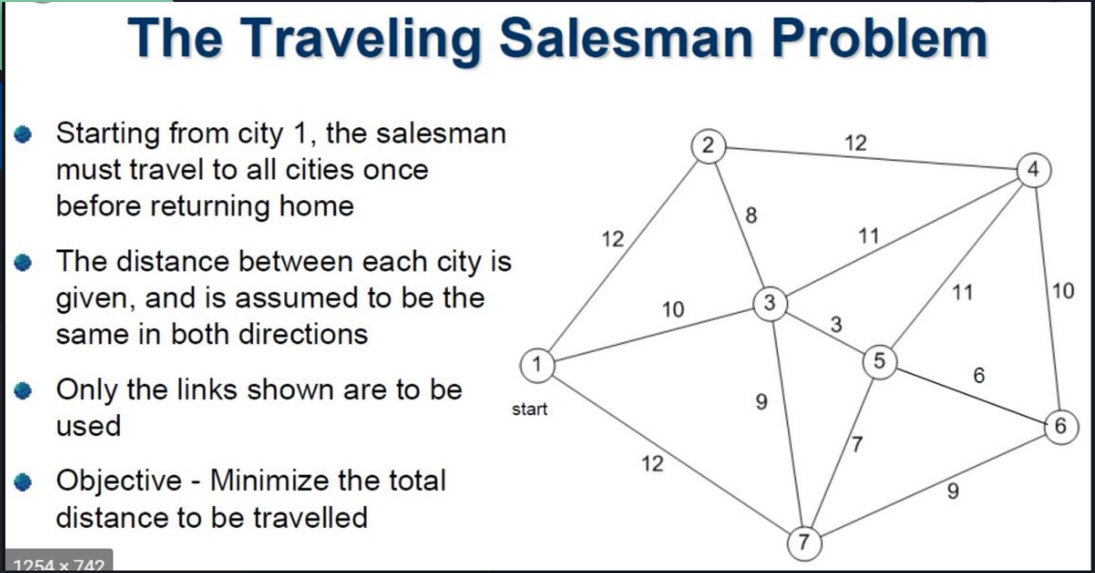
Parallel Genetic Algorithm (PGA)

- Sequential Genetic Algorithm renders the fitness evaluation very costly and sometimes gets stuck in local search space. Hence, PGA is used.
- Three types of PGAs: Master-Slave, Multiple Populations With Migration and Multiple Populations Without Migration.
- One of the three will be chosen for the project.

How it works

- A parallel version of a Genetic Algorithm (GA) is presented and implemented on a cluster of workstations. Even though our algorithm is general enough to be applied to a wide variety of problems, we used it to obtain optimal and/or suboptimal solutions to the well-known Traveling Salesman Problem.

TSP

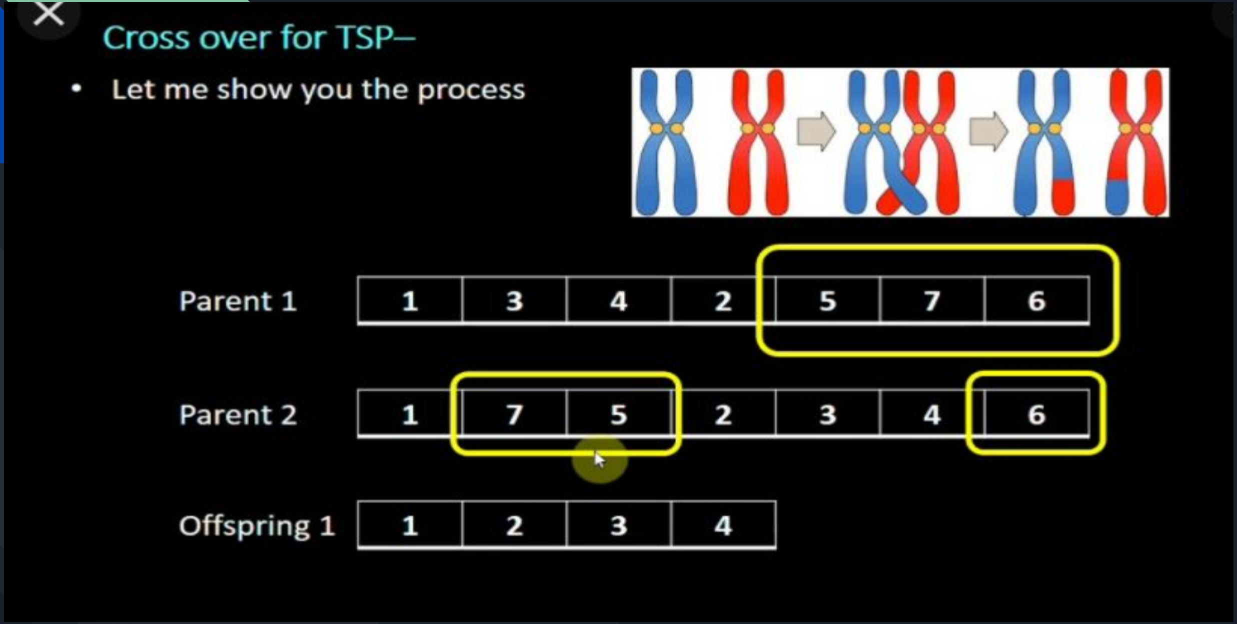


The Traveling Salesman Problem

- Starting from city 1, the salesman must travel to all cities once before returning home
- The distance between each city is given, and is assumed to be the same in both directions
- Only the links shown are to be used
- Objective - Minimize the total distance to be travelled

1254 x 742

Genetic Algorithm



Cross over for TSP–

- Let me show you the process

Parent 1	1	3	4	2	5	7	6
Parent 2	1	7	5	2	3	4	6
Offspring 1	1	2	3	4			