GR-252 An Efficient Algorithm for m-TSP Problem

ABSTRACT

In this research paper, we explore an efficient algorithm for multiple Traveling Salesman Problem (m-TSP). Our novel approach has the promise of producing even workloads for the m salesmen while ensuring fast algorithm performance.

METHODS

We used Mixed Integer Programming (MIP) and K Means clustering to develop our algorithm. Mixed Integer Programming is a mathematical optimization technique which closely resembles declarative style programming language with the goal of maximizing or minimizing a function under certain constraints. We used iterative approach to eliminate sub-tours of salesmen and used virtual cities to transform m-TSP problem into an equivalent TSP problem.

Minimize $\sum_{i=1}^{i=n}\sum_{j=1}^{j=n} c_{ij}x_{ij}$

c_{ij} is the cost of travel between cities i and j

Exit Constraint: Each city i must exit at exactly one j

$\sum_{j=1}^{j=n} x_{ij} = 1, \forall i$

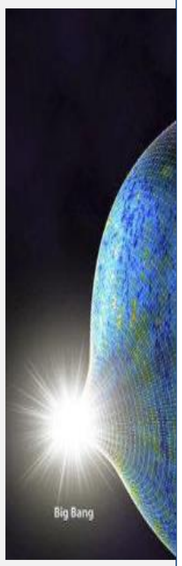
Entry Constraint: Each city j must have exactly one entry point at some i

$\sum_{i=1}^{i=n} x_{ij} = 1, \forall j$

RESULTS

- Our approach produced even work loads for the salesmen on a 48-city dataset.
- The iterative sub-tour elimination converged in 8-10 iterations.
- On a 2.6 GHz, 6 core machine with 32 GB of memory, our algorithm took only 3-4 seconds to produce the tour.

- A brute force approach will require evaluating 48! tours, which will require time larger than the age of the Universe!



- Mixed Integer Programming combined with sub-tour elimination and K-Means clustering produces good solutions while ensuring fast performance.

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