TSP_Theory.pdf – Content

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1. Introduction
The Traveling Salesman Problem (TSP) asks: *Given a list of cities and distances between them, what is the shortest possible route that visits each city exactly once and returns to the starting city?*

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2. Types of TSP

- **Symmetric TSP**: Distance from A to B equals distance from B to A.
- **Asymmetric TSP**: Distances differ depending on direction.

3. Solution Methods

- **Exact algorithms**: Brute Force, Branch & Bound, Dynamic Programming (Held-Karp).
- **Heuristics**: Nearest Neighbor, Minimum Spanning Tree (MST) heuristic, Christofides algorithm.
- **Metaheuristics**: Genetic Algorithms, Simulated Annealing, Ant Colony Optimization.

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4. Performance Measures

- **Tour Length**: Total distance traveled.
- **Computation Time**: How long the method takes to find a solution.
- **Optimality Gap**: Difference between heuristic solution and known optimal.

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5. Applications

- Logistics and route planning
- PCB (Printed Circuit Board) drilling optimization
- Manufacturing machine scheduling
- Drone delivery route optimization