

Vehicle Routing with Pickup and Delivery: A Greedy Approach

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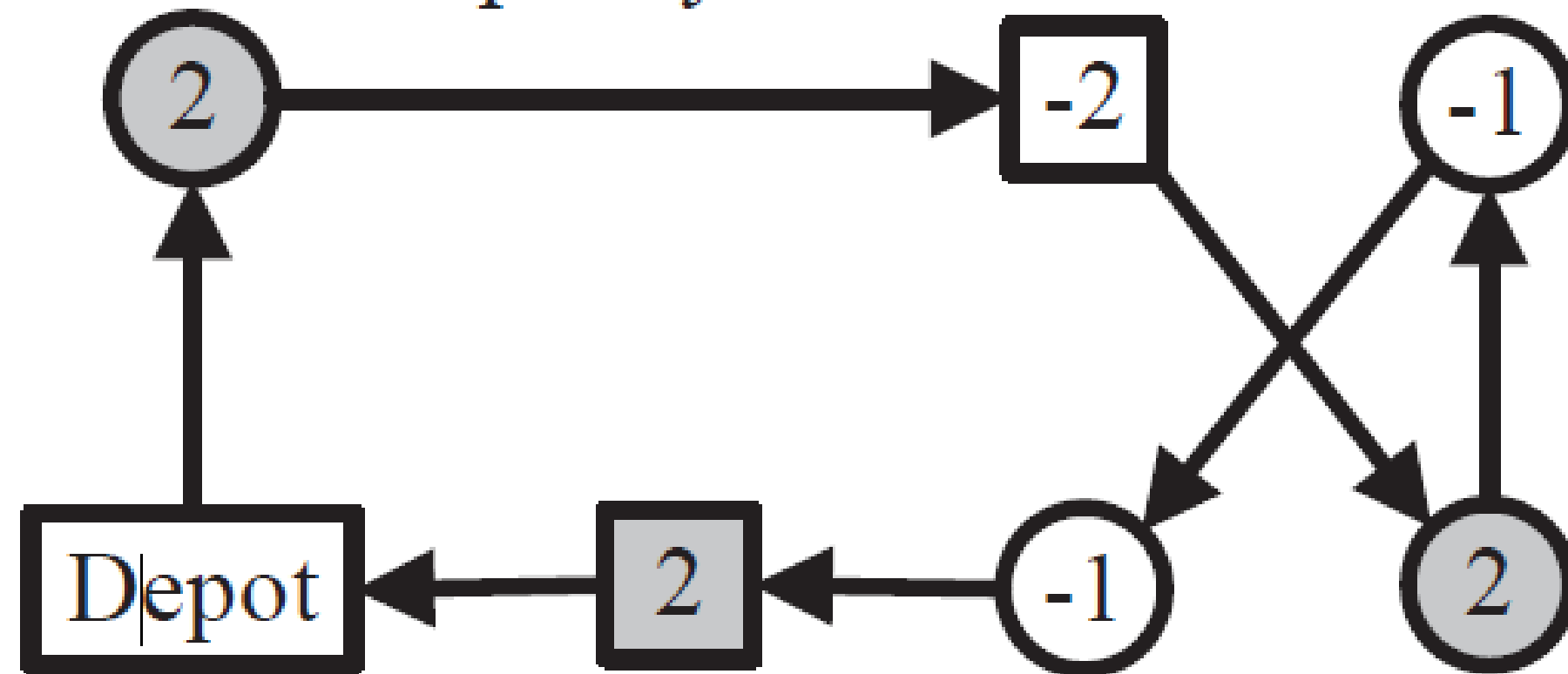
Introduction

- Bike Sharing Systems (BSSs)
 - Bikes in different stations



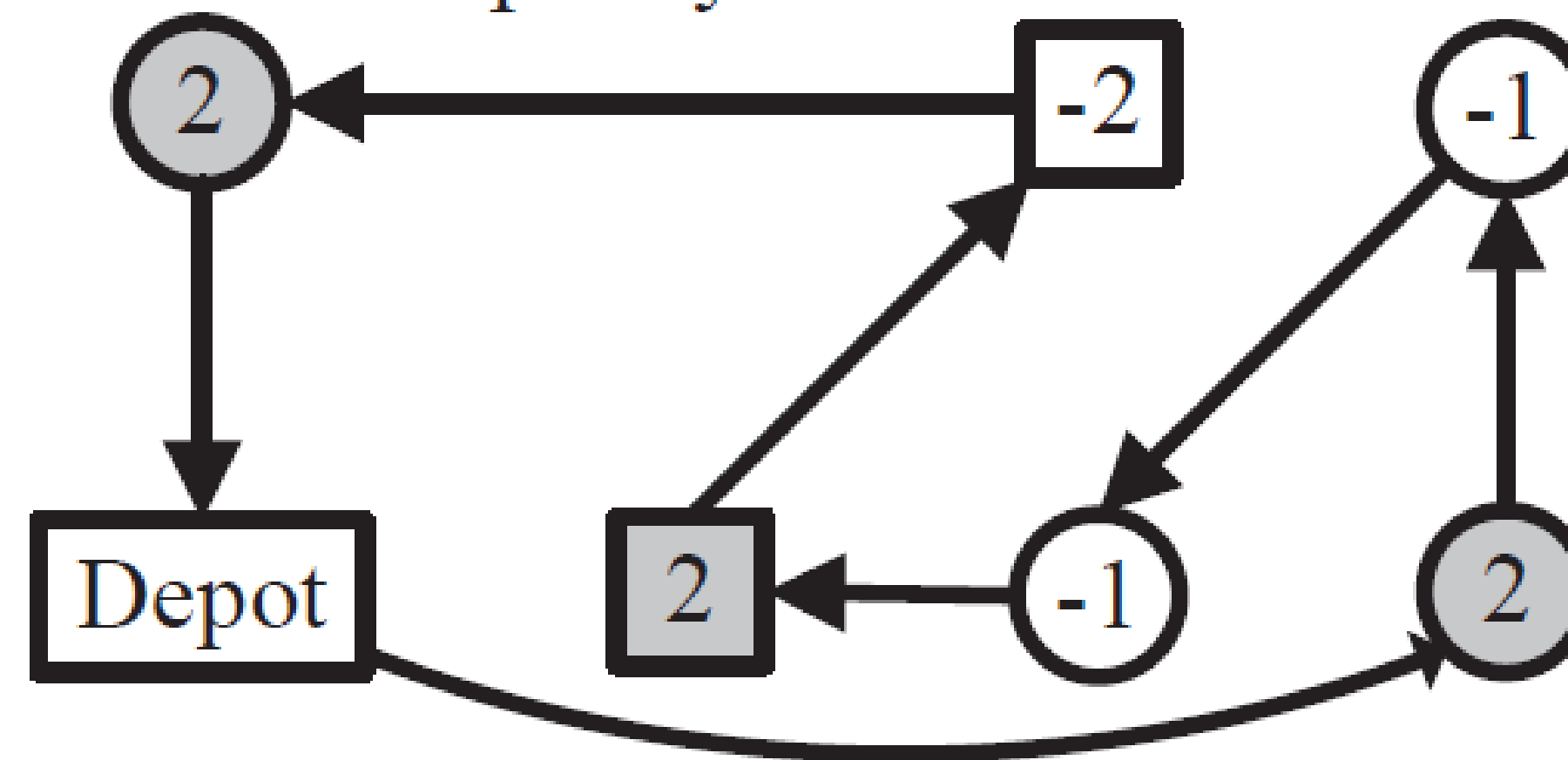
- Rebalancing bikes among different stations
 - Use a vehicle to transport bikes
 - Vehicle is capacitated
 - Stations have different demands

Vehicle Capacity:4



- Multiple companies
 - Stations belong to different companies

Vehicle Capacity:4



System Model and Algorithm

Problem Formulation:

- Objective: minimize the total vehicle routing distances
- Three constraints: vehicle capacity, station demand, multiple companies

Algorithm Design

- Starting with a TSP and trying to switch when constraints are not satisfied

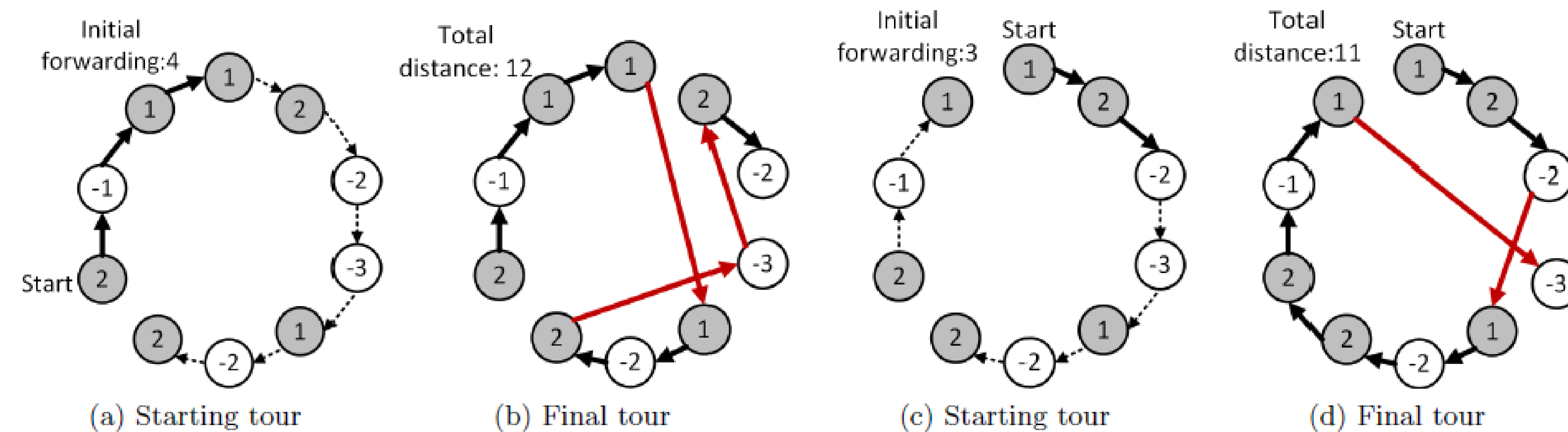
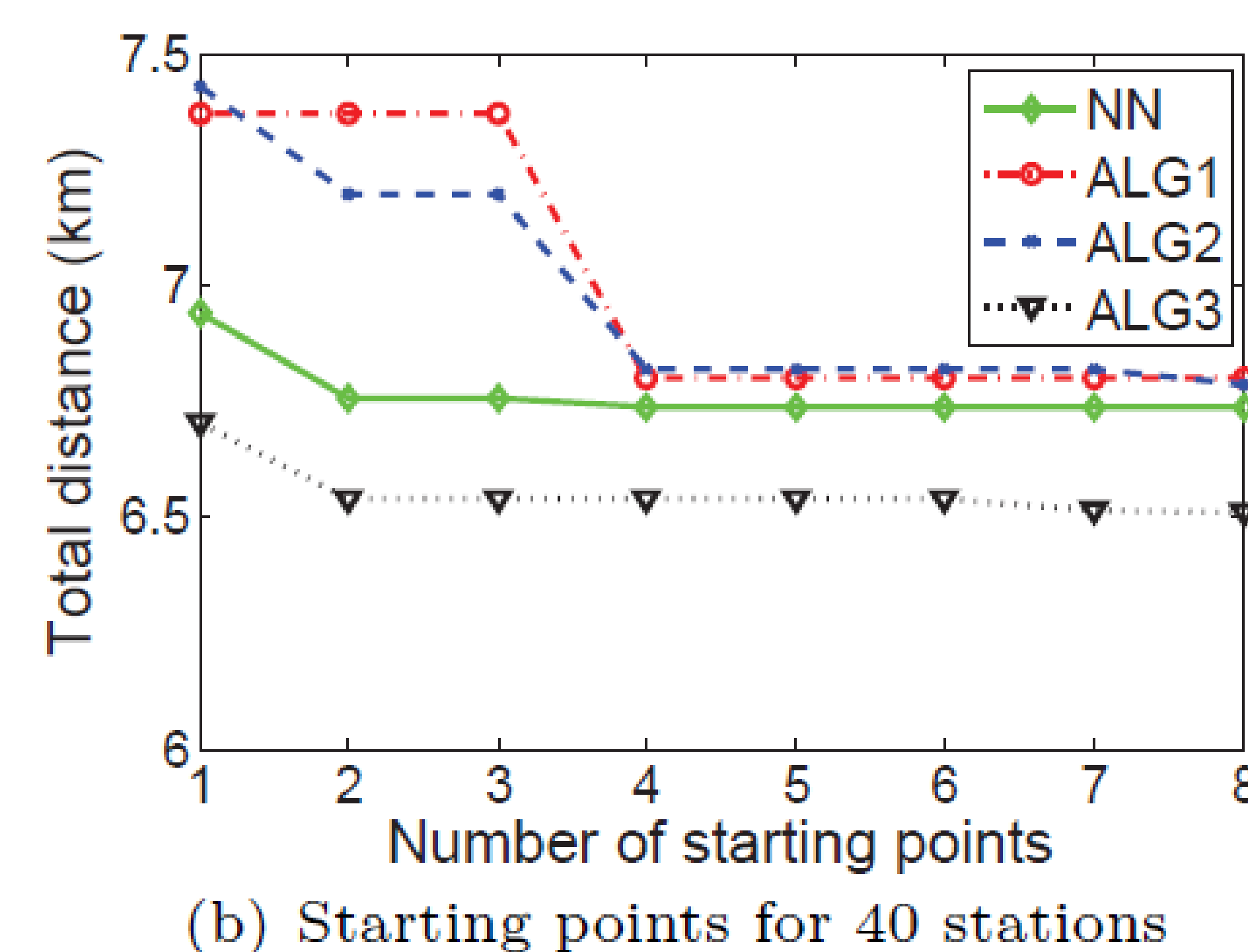


Figure 2: Different starting point: TSP edges (black) have length 1, rewired edges (red) have length 2

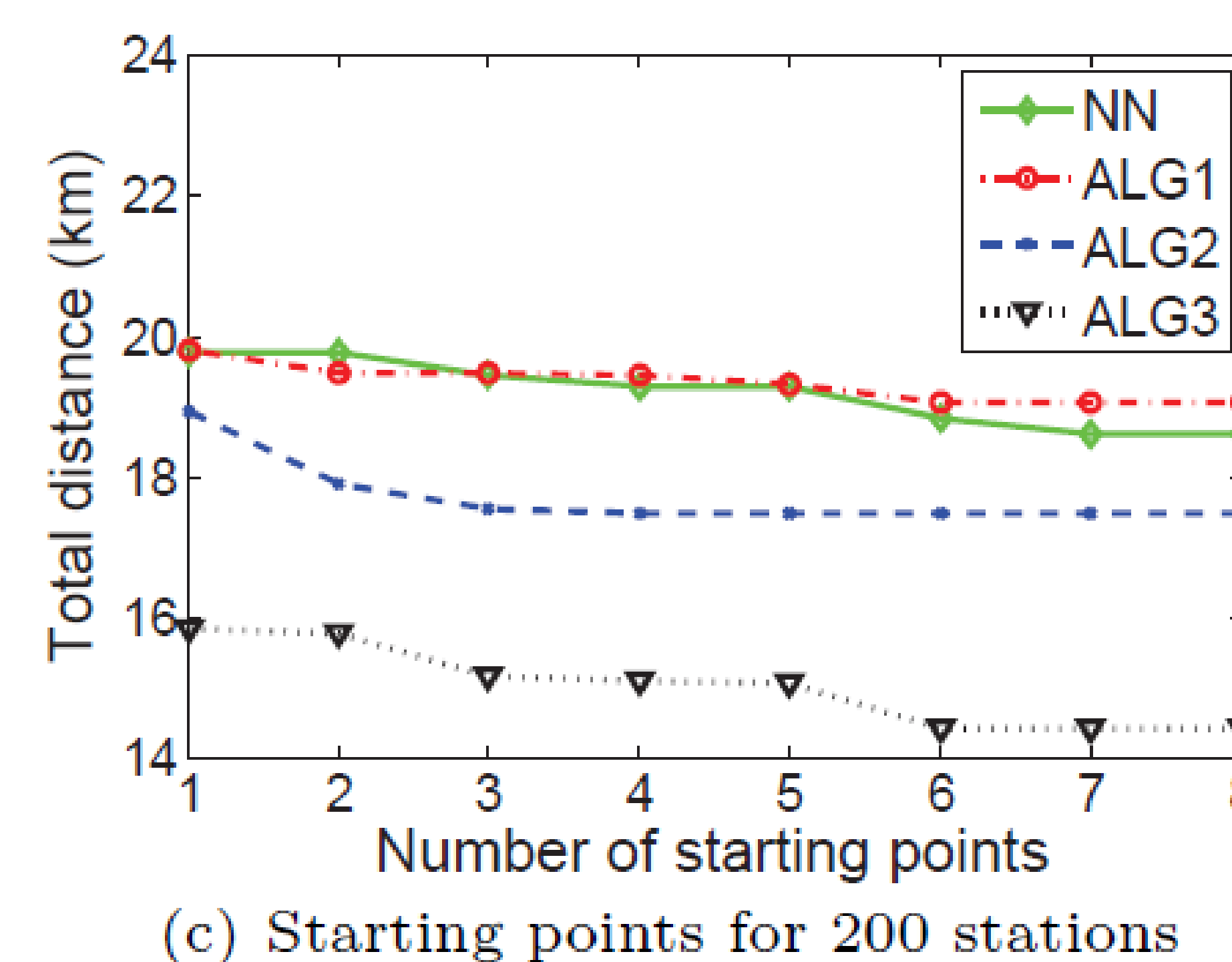
Experiments

• Algorithm variations:

- Use different greedy criteria to switch the TSP



(b) Starting points for 40 stations



(c) Starting points for 200 stations

- More starting points lead to a smaller total distance
- More stations usually require a larger total distance
- The algorithm's run time can be controlled

Challenges

Extension of TSP

- TSP does not guarantee our constraints (vehicle capacity, station demand, multiple companies)
- Solution: switch the TSP when a constraint is not satisfied (the switch must be efficient and effective)

Speed-up the computation

- System scale can be large since bike stations are distributed across the city
- Solution: divide the city based on geometric locations while each location corresponds to a TSP

Future Work

Consider multiple vehicles?

