Static (Deterministic) Vehicle Routing Problems

(Gendreau, Laporte, Potvin, Rousseau, Taillard)

- All information about the problem is known in advance with certainty (e.g., the set of customers and their service demand)

- A solution to the problem (one or more routes) can be constructed in advance.

Traveling Salesman Problem (TSP) and variants
Clustered Traveling Salesman Problem (CTSP)
Vehicle Routing Problem (VRP)
Vehicle Routing Problem with Backhauls (VRPB)
Vehicle Routing Problem with Time Windows (VRPTW)
Vehicle Routing Problem with Backhauls and Time Windows (VRPBTW)
Static Dial-a-Ride Problems
Multiple Depot Vehicle Routing Problems

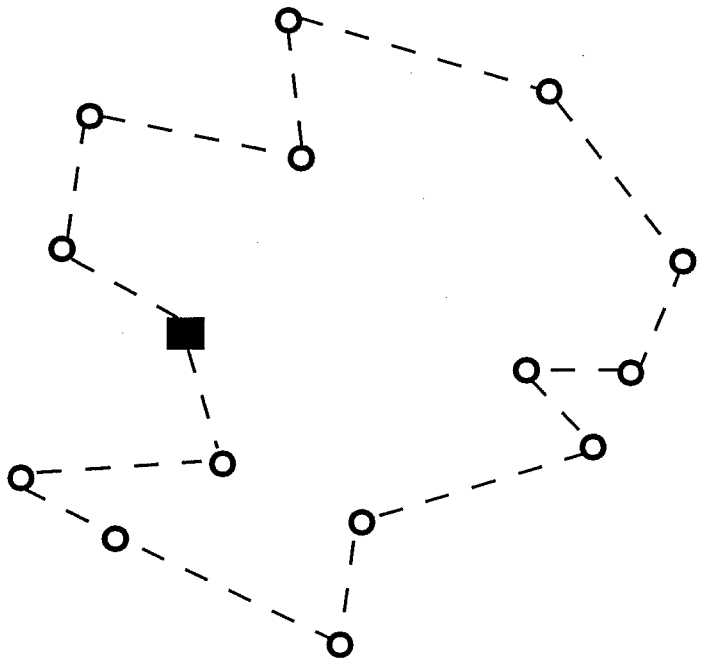
Static (Stochastic) Vehicle Routing Problems

(Gendreau, Laporte)

- Probabilistic information (e.g., the set of customers or their service demand is known probabilistically)

TSP

Assuming that the distance between each pair of vertices is known, construct a tour of minimum length that services all vertices exactly once.

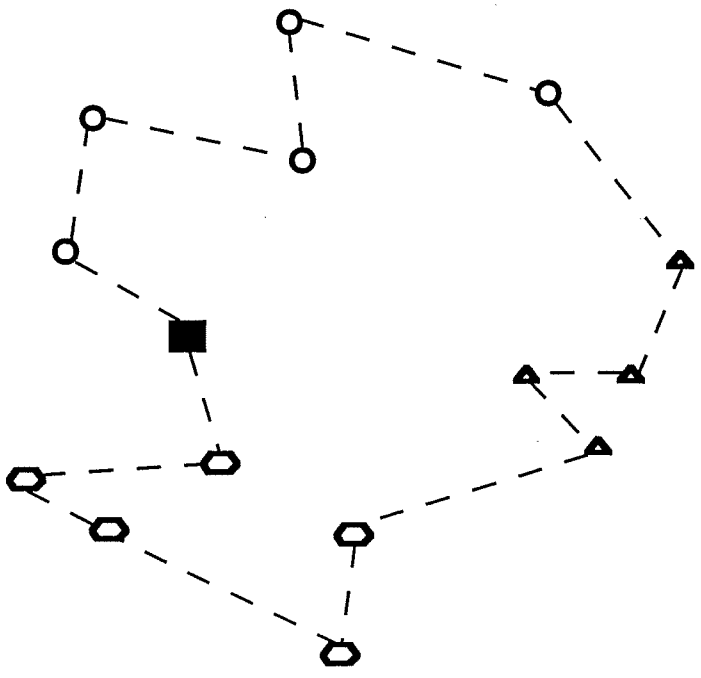


CTSP

Additional constraint:

> The set of vertices is partitioned into subsets of vertices or clusters that must be visited contiguously in the tour. The clusters can be visited in a predefined order or in any order.

Applications are found in production planning, automated warehouse routing.



VRP

The problem is to service a set of customers at minimum cost with a fleet of vehicles.

Characteristics:

(a) the number of vehicles can be variable or fixed

(b) the fleet of vehicles is homogeneous (i.e., same capacity) or heterogeneous.

(c) delivery only (or pick-up only)

(d) known service demand at each customer

(e) each route starts and ends at the central depot (one route for each vehicle)

Constraints:

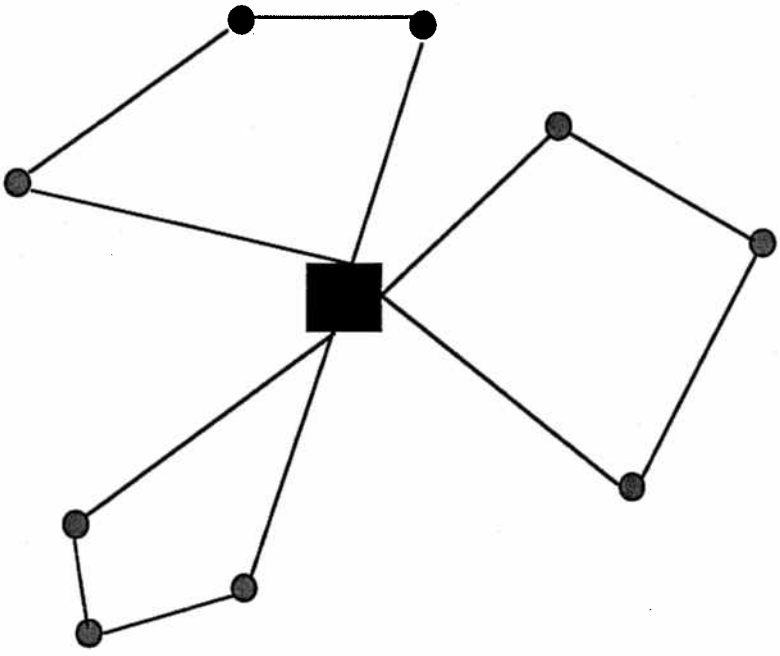
(a) capacity constraints

(b) maximal distance constraints

Objective:

(a) minimize total distance

VRP



VRPTW

Characteristics:

VRP + time windows

hard time windows:
upper bound: hard constraint
lower bound : waiting time

soft time windows

Objectives:

(a) minimize the number of routes (vehicles)

(b) minimize total route time (travel time + waiting time)

Applications: bank deliveries,
postal deliveries,
industrial refuse collection,
school-bus routing and scheduling,
static dial-a-ride problems.

VRPB ou VRPBTW

VRP + precedence constraint between linehaul customers (delivery) and backhaul customers (pick-up).

Static Dial-a-Ride Problems

Each customer has a pick-up and delivery point (two-point requests)

Soft time windows

Example: transportation-on-demand services