

ANR JCJC: HOPES

HOME SERVICE OPERATIONS PLANNING WITH EMPLOYEES PREFERENCES AND UNCERTAINTY

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COLLOQUE IMT :
« LES SCIENCES DE L'INFORMATION AU SERVICE DES
NOUVELLES MOBILITÉS »

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- ▶ Two master students



POLYTECHNIQUE
MONTREAL



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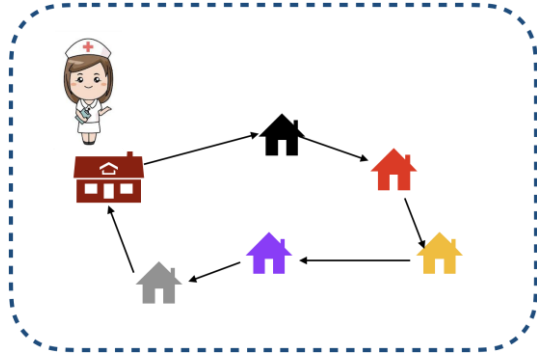


HOME SERVICE OPERATIONS PLANNING WITH EMPLOYEES
PREFERENCES AND UNCERTAINTY

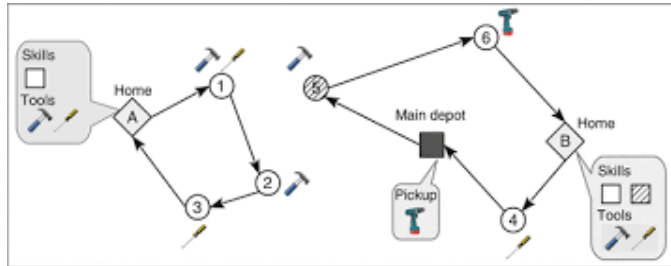
AGENDA

1. MOTIVATION AND CONTEXT
2. OBJECTIVES
3. METHODOLOGY
4. EXPECTED IMPACT AND BENEFITS

MOTIVATION AND CONTEXT OF THE PROJECT



- ▶ Home health care
- ▶ Intervention of technicians
- ▶ Attended home delivery



Pillac, V., Guéret, C., Medaglia, A.L. (2018). A Fast Reoptimization Approach for the Dynamic Technician Routing and Scheduling Problem. In: Amodéo, L., Talbi, E.G., Yalaoui, F. (eds) Recent Developments in Metaheuristics. Operations Research/Computer Science Interfaces Series, vol 62. Springer, Cham.

- ▶ Epidemiological
- ▶ Social
- ▶ Demographic



LOI DE MODERNISATION DE LA SANTÉ (2016)

- ▶ Reduce inequalities
- ▶ Increase quality of life
- ▶ Cost savings

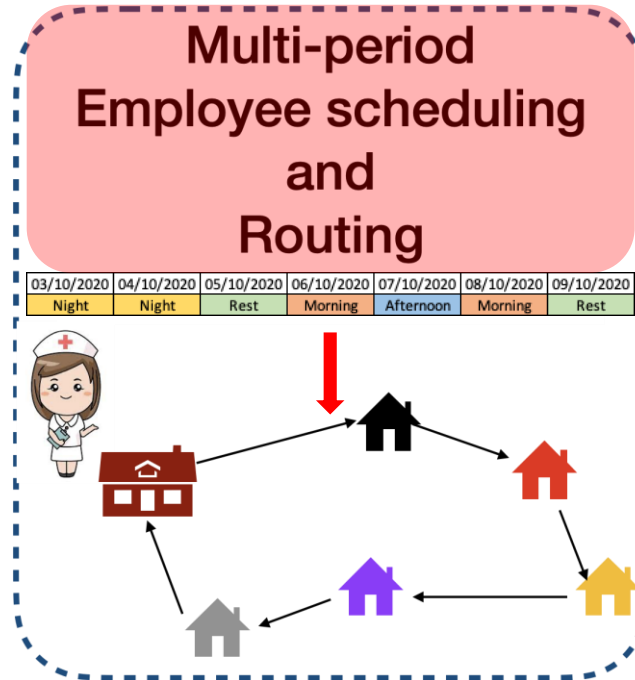
OBJECTIVES

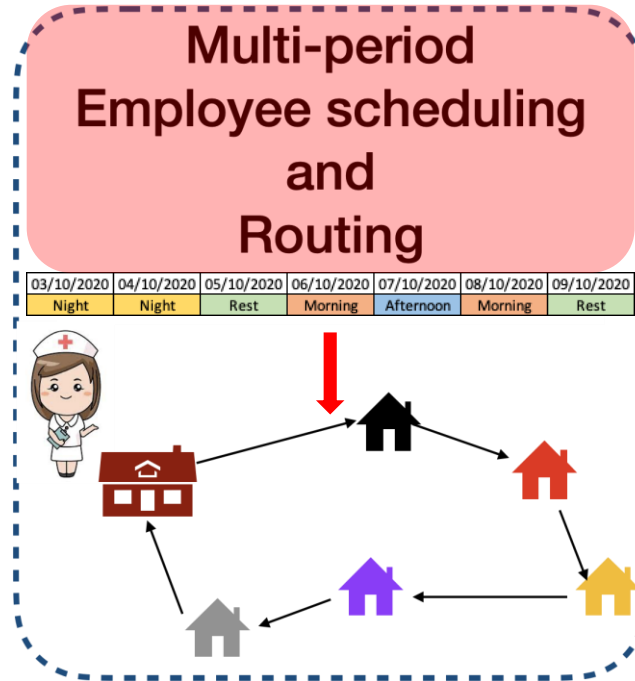
General framework: solve different variants of the problem



- ▶ Avoid non executable and sub-optimal routing and scheduling plans
- ▶ Improve the working conditions and satisfaction of employees
- ▶ Face real-world uncertainty

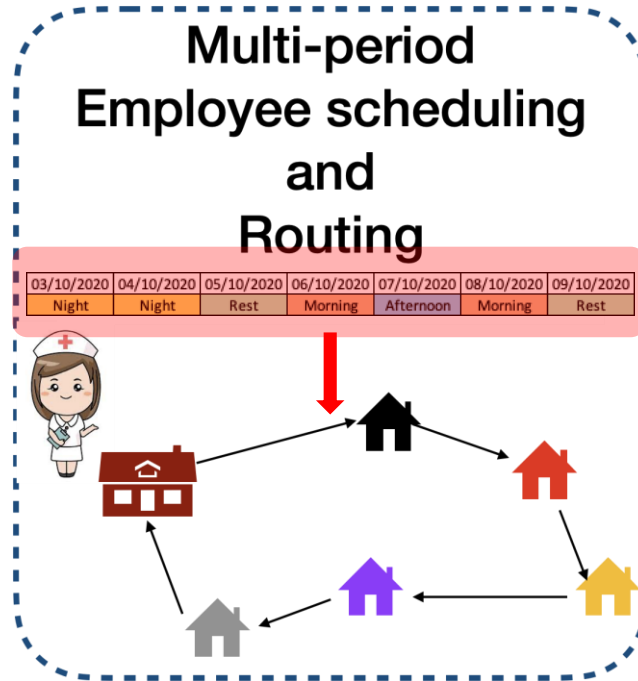
METHODOLOGY

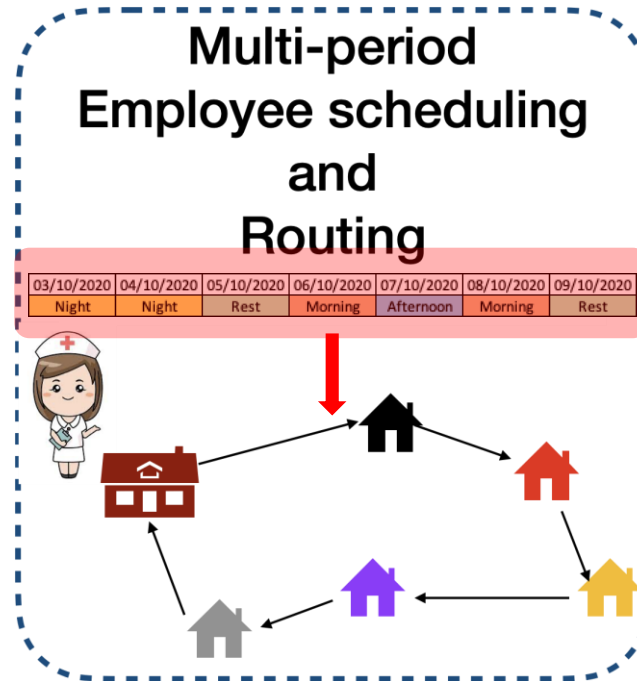




- Continuity of service
- Precedence constraints between tasks
- Legal rules over a week

Dealing with people! →

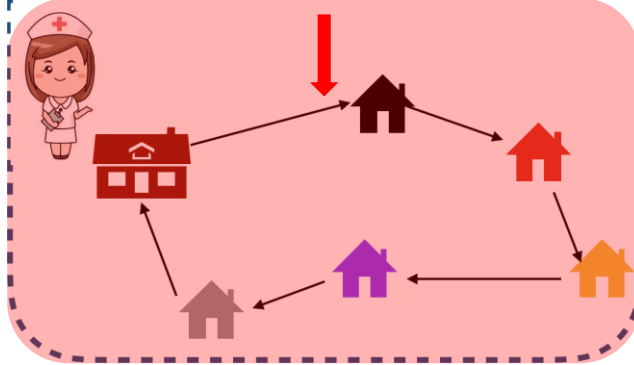




- Employee availability and type of contract
- Min and max number of hours worked per week
- Rest time between shifts
- Days-off allocation
- Max number of nights in a row...

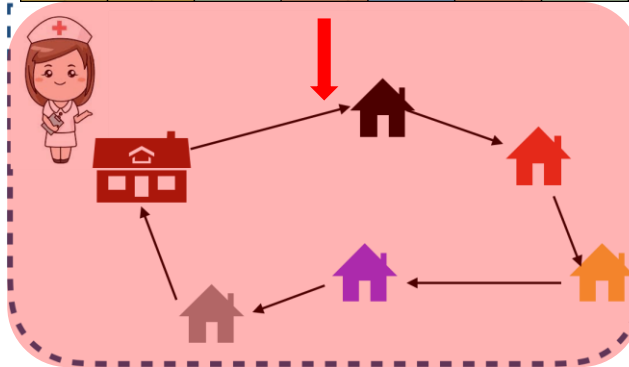
Multi-period Employee scheduling and Routing

03/10/2020	04/10/2020	05/10/2020	06/10/2020	07/10/2020	08/10/2020	09/10/2020
Night	Night	Rest	Morning	Afternoon	Morning	Rest

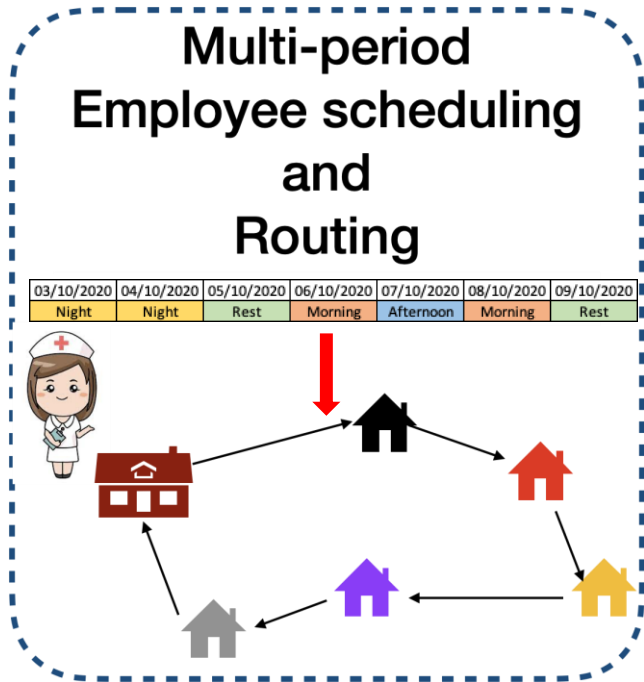


Multi-period Employee scheduling and Routing

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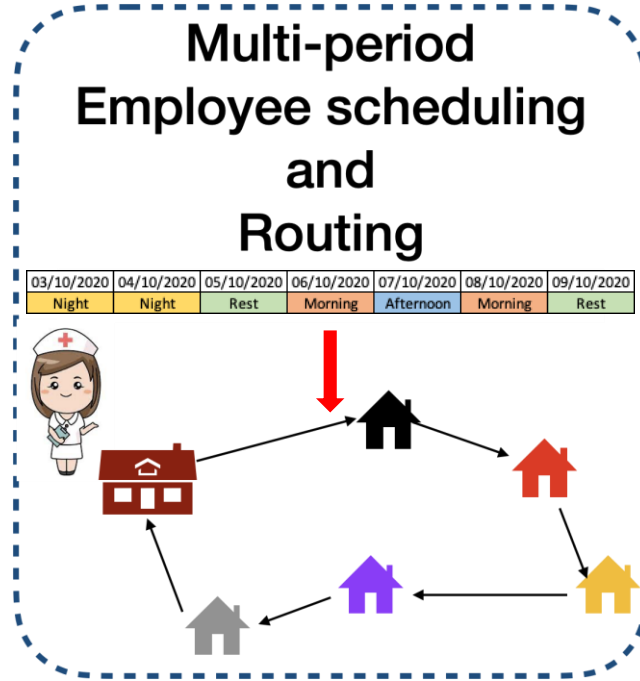
- Employee skills
- Time windows
- Continuity of service
- Precedences between tasks



- ▶ Employee scheduling: Formal languages (automata and grammars)
- ▶ Routing: VRPTW linked to the scheduling decisions
- ▶ Solution method: décomposition approach (Benders decomposition)



Employee preferences for the Type of: shifts, visits...





Employee **preferences**
for the
Type of: shifts, visits...

- ▶ Example: vacant visits
 - Attributes: location, type of task, parking availability, public transport, etc.
- ▶ Caregivers accept or reject depending on the characteristics of the visit
- ▶ Estimate an utility function for each caregiver depending on the characteristics of the visit

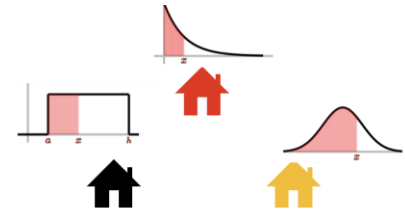
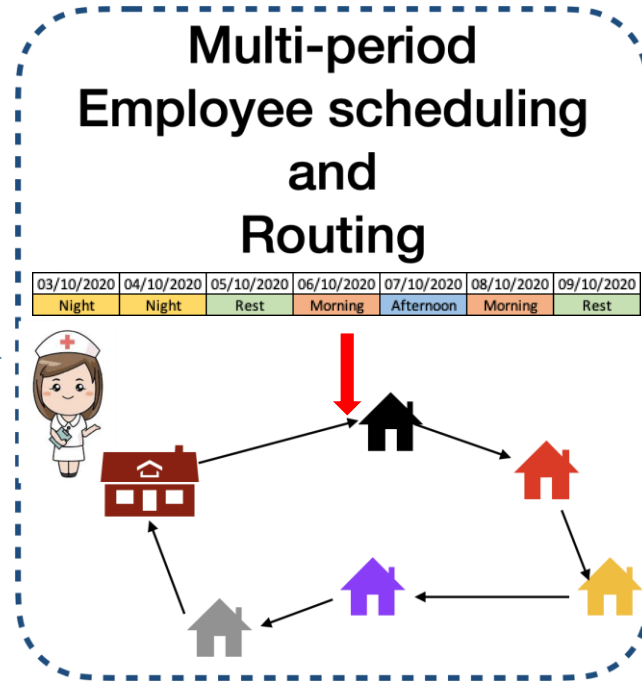


Employee **preferences**
for the
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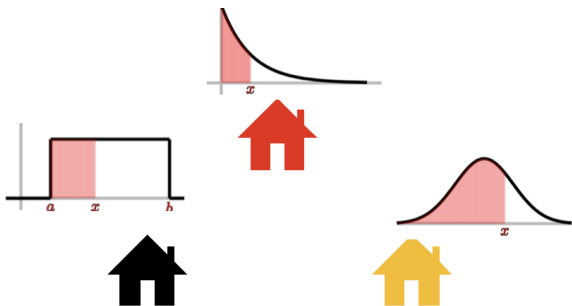
- ▶ Discrete-choice models (DCM) to model the preferences
- ▶ Integration of DCM in the multi-period employee scheduling and routing
- ▶ Implementation of an efficient solution approach



Employee **preferences** for the Type of: shifts, visits...

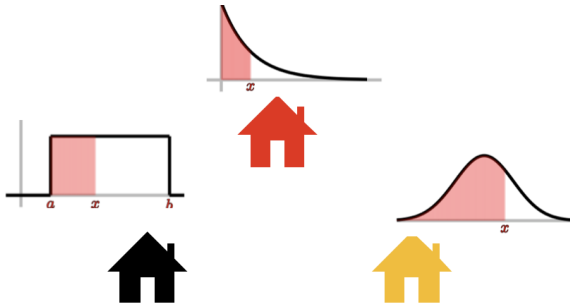


Uncertainty in: Employee availability, service times...



Uncertainty in:
Employee availability,
service times...

- ▶ Example: stochastic service time
 - Depending on the type of task, the type of patient, the type of employee, etc.
- ▶ Some of the actual service times might not lead to a feasible solution, given the patient time windows.



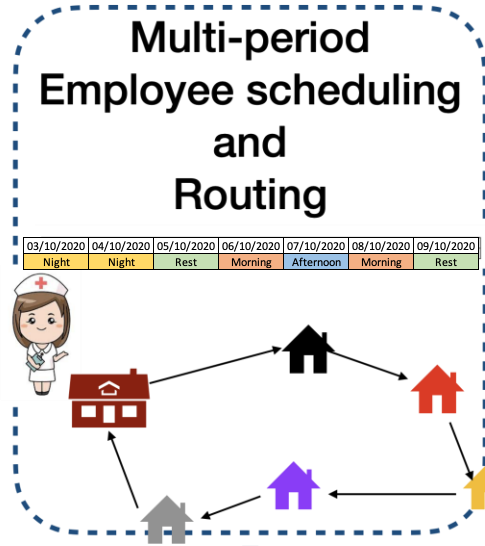
Uncertainty in:
Employee availability,
service times...

- ▶ Two-stage stochastic programming
- ▶ Change constraints
- ▶ Robust optimization



Caring For Caregivers

Employee **preferences** for the Type of: shifts, visits...



Uncertainty in: Employee availability, service times...



Evaluation: Case studies

Company in (France)
AlayaCare (Canada)

Evaluation: Case studies

Company in (France)
AlayaCare (Canada)

- ▶ Make a parallel between practices in the two countries
- ▶ Draw managerial insights
- ▶ Evaluate impact of the project on real data

EXPECTED IMPACT AND BENEFITS

- ▶ Scheduling and routing
- ▶ Choice-based optimisation
- ▶ Stochastic optimisation

Results: highlight future research directions



- ▶ Improve working conditions of employees: homecare sector
- ▶ Decrease operational costs
- ▶ Guarantee service quality: improve the quality of life of patients
- ▶ Facilitate the work of home service planners

QUESTIONS?