A capacitated Vehicle Routing Problem with pickups, time windows and packing constraints in the context of city logistics
Plan

1 Parameters

2 Aim

3 Packing

4 Summary

5 Literature

6 Pickup vs delivery

7 Applications
Parameters

$[A_0; B_0]$
Parameters

\[
[A^1; B^1]; C_1 \quad [A_0; B_0] \quad [A^2; B^2]; C_2 \quad [A^3; B^3]; C_3
\]
Parameters

\[ [A^1; B^1]; C_1 \]

[Diagram of a truck with number 4 and labels A_4 and B_4]

\[ [A_0; B_0] \]

[Diagram of a house]

\[ [A^2; B^2]; C_2 \]

[Diagram of a truck with number 1 and labels A_1 and B_1]

\[ [A^3; B^3]; C_3 \]

[Diagram of a truck with number 2 and labels A_2 and B_2]

[Diagram of a truck with number 3 and label A_3]

Lunch talk
Leloup Emeline, Paquay Célia, Pironet Thierry
Parameters

\[
[A^1; B^1]; C_1 \\
\]

\[
[A_0; B_0] \\
\]

\[
[A^2; B^2]; C_2 \\
\]

\[
[A^3; B^3]; C_3 \\
\]

\[
[A_4; B_4]; S_4 \quad 4 \]

\[
1 [A_1; B_1]; S_1 \\
\]

\[
3 [A_3; B_3]; S_3 \\
\]

\[
2 [A_2; B_2]; S_2 \\
\]
Parameters

\[ [A^1; B^1]; C_1 \]
\[ [A_0; B_0] \]
\[ [A^2; B^2]; C_2 \]
\[ [A^3; B^3]; C_3 \]

\[ [A_4; B_4]; S_4 \]
\[ [A_1; B_1]; S_1 \]
\[ [A_2; B_2]; S_2 \]

\[ D_{04}; T_{04} \]
\[ D_{01}; T_{01} \]
\[ D_{14}; T_{14} \]
\[ D_{02}; T_{02} \]
\[ D_{03}; T_{03} \]
\[ D_{24}; T_{24} \]
\[ D_{13}; T_{13} \]
\[ D_{34}; T_{34} \]
\[ D_{23}; T_{23} \]
\[ D_{12}; T_{12} \]

Lunch talk
Leloup Emeline, Paquay Célie, Pironet Thierry
Packing

- Each box is completely inside the vehicle transporting it
- No overlap between boxes in a same vehicle
- Stability of boxes (i.e. the box is on the ground or its four corners are supported by other boxes)
- Rotations
- Fragility (in the sense of non stackability) of boxes
Final packing
Split pickup vs no split pickup
Reloading vs no reloading
Homogeneous vs heterogeneous vehicles
Time windows vs no time window
Selection of boxes vs all boxes
Selection of customers vs all customers
Summary

- Homogeneous fleet of vehicles
- A vehicle leaving the depot ends up at the depot
- Travel duration does not exceed the maximal travel duration
- Trips occurs within the different time-windows
- Each customer is visited by exactly one vehicle
- All customers’ boxes are loaded
- All vehicles’ capacities are respected
- Each box is completely inside the vehicle transporting it
- No overlap between boxes in a same vehicle
- Stability of boxes (i.e. the box is on the ground or its four corners are supported by other boxes)
- Rotations
- Fragility (in the sens of non stackability) of boxes
Combination of two difficult problems

Heuristics

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Based on the article by Pollaris, Braekers, Caris, Janssens, and Limbourg (2015)
Dynamic i.e. last moment changes:

- the dimensions of the boxes vary from what was mentioned
- the weights of the boxes vary from what was mentioned
- a customer cancels (can change the packing solution)
- some boxes are missing (can change the packing solution) or some boxes are added
- a new client arrives during the day
- time windows of one or several customers are modified (boxes not ready,...)
- there is unexpected traffic jam
• Limited impact on the deterministic and static part of the problem
• Allow to change the plan in the dynamic version of the problem
bulky home application

ideas are welcome (enterprises, etc)
Thanks for your attention!