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INF379 - Assignment 2 – Solution Representation

In the following I will make a suggestion as to how one could represent a solution to the Vehicle/Drone problem stated in the Lecture no. 5 in INF379.
My first thoughts went to representing this solution in a similar way to Vehicle Routing Problem representation ie. permutations. However there are a few other aspects in this problem that seems to be of importance that is different from the standard VRP which is the set of drones. The easiest way to solve this would seem to represent the solution in the form of a matrix:

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0	0	10	9	8	7	3	5	6	0
1	11	10	-1	-1	-1	1	-1	-1	-1
2	-1	12	9	-1	4	2	5	-1	-1

Column index: Drone(1-2) or Vehicle (0), row index: the order of visit.

This matrix does seem to entail all the info we need, however it can turn into a rather large matrix (NxD) for large N and D's. So a normal permutation would be better if we can find a way to indicate what a drone is and which drone we are talking about. Lets say that we index each drone from 1-D. And we use normal permutation representation of the path of the truck. But whenever we are sending out a drone (from the position we are currently in), we indicate that with a negative value and whenever a drone is returning we indicate that with the same negative value:

An example:

-1	11	10	-1	-2	12	9	-2	8	7	-2	4	3	-2	-2	2	-1	1	5	-2	-1	6	0

From this representation it is easy to present the resulting path/edges as follows given a starting point at depot 0:

Vehicle: 0-10, 10-9, 9-8, 8-7, 7-3, 3-5, 5-6, 6-0.
Drone 1: 0-11, 11-10, 3-1, 1-5
Drone 2: 10-12, 12-9, 7-4, 4-3, 3-2, 2-5

Whenever the value is negative it means that a drones leaves to the following numbered node. The negative number indicates which drone should move, index being from -1,-2,-3,..., -D. The second time the same negative value appears the drone will return to where the car currently is. If there is no negative value that indicates the next stop of a car.

Feasibility: To check the feasibility of a solution represented as above one could check if each starting point of a drone is before its end point. F.eks. drone 1 delivering to customer 11 has a starting point of 0 and an end point of 10. 10 comes after 0 on the trucks delivery route so this is feasible. If you also have limitations like time you could also use the representation to check if the drone can make the delivery in the time frame that the car uses from 0 to 10. Other feasibility questions should also be possbile to answer with the representation described.