

# Assignment 1 Metaheuristics

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### Liner Shipping Problem

Representation for given solution to the problem:

S6050780040321S

Here S is a unique number other than the node numbers, e.g.  $|\text{nodes}| + 1$ .

#### Rules for this general solution representation:

It must start and end with the number S as this is the continental port we ship from and back to. These cannot be moved.

- New numbers indicate new port being visited either by
- One zero (with no other zeros surrounding it) indicates launching of a daughter vessel.
- The number(s) following the launching of a daughter vessel indicates the route of the daughter vessel from the mothership port.
- A daughter ship route is ended and goes back to mothership port either by one zero indicating the launch of another daughter ship, or two subsequent zeros indicating no more daughter ships launched from this mothership port and mothership will move to the port represented by the following number.
- Every port number should be mentioned in the solution.
- If shuffled, three subsequent zeros delete the first of them, giving to subsequent zeros.

#### Comments on solution:

This representation should give a one-to-one solution, leaving no ambiguity over the solution at hand. I believe its compactness is its strong suit, making use of only one array and has an integer range of 0 to  $|\text{nodes}| + 1$ . Shuffling between the start and endpoint gives valid solutions. Its weakness though is that shuffling doesn't give you every possible solution. For that one would need to add more zeros to play around with number of daughter ships.

### Drone Problem

Representation for given solution to the problem:

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

#### Rules for this general solution representation:

- New unique integers indicate a move to this node.
- First integer of solution, or new integers following another integer indicate truck movement.

- An integer following a dash indicates launch of a drone to this node from truck location.
- Repeated integer indicates the return of a drone from this (drone-)node to the current truck location.
- Only integers following a dash can be repeated, and these must be repeated.
- A maximum of two dashes can follow each other without an integer being repeated (indicating drone return). It can add another dash for each integer repeated. Maximum 2 dashes without repeated integers in between them in the sequence.
- Dashes must follow and be followed by an integer.
- If one shuffles the solution, then for every integer repeated twice in the sequence, make sure the dash is in front of the first mentioning of this integer.

E.g: 0-11 10-12 9 11 12 8 7-4 3 4-2-1 5 2 1 6 → 0 10-12 9 11 12 8-11 7-4 3 4-2-1 5 2 1  
→ 0 10-12 9-11 12 8 11 7-4 3 4-2-1 5 2 1

**Comments on solution:**

Compact solution. Shuffling is quite difficult leading to invalid solutions without cleaning. It is also hard to make improving changes as one would need to add more or remove integers if one where to use a different amount of drones. Therefore, it is not very close to the actual solution space. Its perk is readability.