AI505 – Optimization

Sheet 10, Spring 2025

Exercises with the symbol [+] are to be done at home before the class. Exercises with the symbol [*] will be tackled in class. The remaining exercises are left for self training after the exercise class. Some exercises are from the text book and the number is reported. They have the solution at the end of the book.

Exercise 1[+]

Model and solve in MiniZinc the bin packing problem: you are given a set of items each with a size and a set of bins each with a capacity that limits the total size of the items that can be placed in it. Your task is to place the items in the minimum number of bins such that the capacity constraint is not exceeded. Focus on modeling the problem with both arrays of variables and arrays of set variables. Calculate a lower and upper bound on the number of bins before starting the solution process.
Document yourself about MiniZinc using the references listed in Unit 7.
Solve the two following problem instances:
Small:

```
int: cap = 10;
int: n = 11;
array[1..n] int: size = [6, 6, 6, 5, 3, 3, 2, 2, 2, 2, 2];
```

Large:

```
int: cap = 100;
int: n = 50;
array[1..n] int: size = [
  99,98,95,95,95,94,94,91,88,87,86,85,76,74,73,71,68,60,55,54,51,
  45,42,40,39,39,36,34,33,32,32,31,31,30,29,26,26,23,21,21,21,19,
  18,18,16,15,5,5,4,1];
```

An optimal solution for the small instance:

Exercise 2[*]

Build an heuristic solver for the Traveling Salesman Problem using the ROARNET-API specification. Reuse the code from exercise 6 of Sheet 09 to generate an instance and to represent the problem.