**Homework 1: (TA will give some additional explanations)**

Create two examples for each task. One is a standard easy-to-understand example which can be similar to other students' examples. The other is your own example with high novelty which is generated using your own creativity.

**Task 1-1.** Two examples to demonstrate the strength of the simple nearest neighbor greedy algorithm. We can always obtain the optimal solution independent of the choice of a start city.

**Task 1-2.** Two examples to demonstrate the importance of the choice of a start city. We can obtain the optimal solution from some start cities, but the obtained solutions from other start cities are worse.

**Task 1-3.** Two examples to demonstrate the weakness of the simple nearest neighbor greedy algorithm. We cannot obtain the optimal solution independent of the choice of a start city.

**Task 1-4.** Two examples to demonstrate the importance of the choice of a tie-breaking mechanism. Different solutions are obtained depending on the choice of the next city from two or more cities with the same distance from the current city.

<span style="color:red">Create two examples for each task.</span> One is a standard easy-to-understand example which can be similar to other students' examples. The other is your own example with high novelty which is generated using your own creativity.

**Task 2-1.** Two examples to demonstrate that a very bad solution can be obtained by the simple nearest neighbor greedy algorithm (i.e., that the worst case result is very bad). The following approximation quality can be very bad depending on the choice of a start city (e.g., close to 2.0 or higher than 2.0).

$$\textbf{Solution Quality} \ = \ \frac{\textbf{Obtained Tour Length}}{\textbf{Optimal Tour Length}}$$

**Task 2-2.** Two examples to demonstrate that inversion-based local search (2-edge change local search) cannot always improve the solution obtained by the simple greedy nearest neighbor method (i.e.,  show two greedy solutions which cannot be improved).